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INFORMATION, DEVELOPMENT STYLES AND ENVIRONMENTAL PROBLEMS IN
LATIN AMERICA

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The importance of information for studying the relationship between development styles and environment in Latin America will be examined here from two perspectives:

- (1) The structure of information supply as a basic element of the ascending transnational development style.
- (2) The viability of optional information strategies for addressing environmental problems.

Prior to the analysis of these two problems, some of the basic concepts related to information, development styles and environment, will be defined.

A. Information

For the purpose of this paper, information (or "technical information") is scientific, technological and socio-economic data which have been characterized (by anyone) as authoritative and relevant. This is a narrower definition than a more usual one: that information is distinguished from data by the former's potential usefulness.

An information strategy intends to assure the availability and/or delivery of information, with certain prescribed qualities (in addition to authority and relevance), to users, by means of the study, diagnosis, design and implementation of information services (loan, dissemination, retrieval, reference, translation and reprography) and information support functions (acquisition, selection, classification, technical processes, interpretation, storage, transmission, purchase and maintenance of equipment, personnel operations). The responsibilities of these services and support functions are formally assigned very often to information centres (libraries, documentation centres, statistical units, computation centres, archives, etc.) staffed by information specialists (librarians, documentalists, systems analysts, programmers, statisticians, archivists), or other intermediaries (anyone who carries out an information service or support functions). The

/rational explicit

rational explicit assignment of responsibilities related to the exchange among various intermediaries or institutions of a certain type or collection of data is called an information network. In information systems other than networks, the intermediaries may assume functions which are not explicitly assigned to them.

Information systems can be of a temporary or permanent nature, and can specialize in disaggregated or aggregated data, unanalyzed or analyzed data, or reference information which **summarizes** and helps to locate the basic or primary information sought by the user. On this basis, information systems may be characterized by one or more of the following elements: 1/

- a. Functional- or problem- oriented systems (systems designed to provide information for very specific predefined uses).
 - a.1. Systems of traceable data (systems which process data already normally collected in private and public administrative activities).
 - a.2. Systems of non-traceable data (systems which generate and process data not normally available in on-going administrative activities, usually requiring a special census, research or other data gathering project).
 - a.3. Management information systems (MIS) (systems intended for long-term use, with information outputs directly related to decision-making functions in an organization).
 - a.4. Selective dissemination (a system of matching information inputs with profiles of user information requirements in order to select the information with greatest probability of usefulness to the user).
- b. Supply-oriented systems (systems designed to provide information for a potentially wide variety of applications, whereby the outputs cannot be predefined except in the very general terms and capabilities are flexible).
 - b.1. Individual data bases (sets of data on a specific subject matter, which are organized in a predetermined fashion and are retrievable by means of indexes which invert the order of the data entries e.g. the data may be ordered by institution of origin or author and can be accessible by subject indexes).

/b.1.a. Computerized

- b.1.a. Computerized data bases (retrival is by on-line or batch processing).
- b.1.b. Published subject bibliographies (indexes, abstracts, periodical bibliographies), other reference materials (encyclopedias, dictionaries, directories, etc.)
- b.1.c. Statistical bulletins, academic or professional journals
- b.1.d. Specialized documentation collections, by subject matter or type of document (maps, technical reports, etc.)
- b.1.e. General documentation collections (public or school libraries, bookstores, etc.)
- b.2. Packages of data bases, so that the user can engage in retrieval simultaneously from many individual data bases, having bibliographies or reference lists prepared tailor-made to needs.
- b.3. Archives (whereby the documents or data are ordered simply, by institution of origin or another criterion, and not having an inverted index to facilitate retrieval)
- b.4. Bibliographic control of national publications and other documents and conservation of these documents in a national library or in legal deposits.

An information supply is characterized by a set of qualities of data during the entire flow from that data's source to their final application. The qualities include authority (the importance which the user or recipient assigns to the data, considering the source of that data), relevance (the importance which the user or recipient assigns to the data, considering the content or meaning of that data), 2/ redundancy (extent of duplication with the data already at hand), timeliness (if the delivery anticipates the need), periodicity, regularity (reliability of delivery according to the anticipated periodicity), obsolescence (the usefulness of the data, considering the time period of its content), quantity, compression (reduction of the quantity of data into codes which occupy less space), and accuracy (of the representation by the data of determined conditions, events or ideas). In addition, the channels of the information flow have determined qualities of transmission

/capacity and

capacity and efficiency, and coding/decoding efficiency. These qualities of information supply are matched, in a complete information strategy, with the prescribed information requirements and studied information habits and capacity of the information users.

An information strategy is basically a negotiation process, for two reasons: (a) The qualities of information and information flow which are available seldom coincide with those of the information requirements and some compromises must be made; (b) the users of information are also sources (and usually intermediaries) of it, and for the sources, information represents political power and authority; information is usually exchanged for something else.

There are other characteristics which are ascribed by economists to information, and because they distinguish information from other economic commodities, it is presumed that the exclusion of the value of information from economic analyses is justified. On this leads to an exaggeration of the differences between information and other objects of international economic transactions, and to arguments that it is especially difficult to overcome dependencies based on the control of information by more powerful countries or groups. A more accurate characterization of information suggests that: (a) the recipient of the data seldom knows their value and qualities before receiving them, but in fact the data could be subject to technology assessment in terms of the qualities indicated above; (b) in theory the provider or intermediary does not lose control of the data when delivering (a copy of) them to the recipient; but in fact it is necessary to study each transaction separately to see if the value of those data for the provider increases or decreases when he transfers them; (c) the data can gain as well as lose in some measure the qualities indicated above as they are transferred and processed in the flow; and (d) while information intermediaries do play a vital role in selecting (and discarding), interpreting and processing data in order to transfer useful information to the user, this is a role which often is cultivated successfully without any formal training, preparation or appointment.

/Information has

Information has been a relatively neglected element of environmental systems, especially in developing countries. Although there is a considerable effort expended in the design and implementation of information strategies, the accumulation of data in key points ("nodes") of the network, and data allocation (dissemination) or availability (for retrieval) among members of a polity or organization (or clientele), are seldom given the same attention as is the allocation of human energy or material for the endeavors of that polity or organization. In this sense, information is the "freest" (least compromised) of the basic elements, even though it can be the most vital for obtaining or retaining political power. Perhaps it is also the least understood and most misunderstood of the elements. As a result, the existing information systems and networks in Latin America, on the whole, are products or imitations of strategies elaborated by persons and organizations who place national development requirements in this region in a secondary position, if even that. And the situation is characterized by a very high grade of technological dependence.

B. Environment

The discussion in this paper will focus on strategies for information handling regarding habitat, natural resources, pollution and other specific contemporary environmental problems, but it is pertinent to take a longer view and consider also the information strategies which would be appropriate to assure permanent consideration of environmental concerns, however these might be defined at any given moment. For the implementation of new information systems to address urgent problems, it may be an efficient recourse for the short run to use the strategies which information scientists propose in recent textbooks on individualized and specialized data bases and on international networks. However, the price for the efficient delivery of information in the short-run is likely to be compounded rigidities and difficulties in the long-run. Anticipating this, a broader definition of "environment" is in order, based on the constant evolution of what are considered as appropriate systems' boundaries.

/All decisions,

All decisions, studies, issues and problems are circumscribed by temporal, spatial, methodological and other boundaries. Much of the professional and political debate that takes place is related (implicitly or explicitly) to divergent points of view regarding the appropriate boundaries of a subject under discussion, then to the solutions which should be adopted. The limits of what it is considered legitimate (reasonable, practical, pertinent, etc.) to talk about, or study, or take into account, in the face of a particular problem or challenge, encompass a system. While organizations (in terms of organizational goals), professions (in terms of professional qualifications), sciences (in terms of Kuhnian paradigms), coalitions (in terms of agreements) and other groups may agree on the nature or definition of the system, which is the subject matter for their attention, most systems are actually in a constant state of flux. Goals, qualifications, paradigms, agreements, etc. are usually temporary (although important for their duration) and subject to interpretation.

Table I cites a number of systems which are presently used in socio-economic and technological decision-making and systems analysis, including cost-benefit analyses and operations research, and which exclude environmental costs and benefits of increasing interest internationally. The environment consists of the residual variables not incorporated into the system, and values which have not been considered relevant for the system variables. The environment can be all such residual variables or values, or may consist only of those "additional" variables and value ranges which, according to the critics of a system, should be taken into account.

An environmental problem is a problem or matter on which serious disagreement exists regarding the appropriate limits of the systems being studied, discussed or implemented.

One class of environmental questions is the general question of how to expand system boundaries, beyond what has been considered theoretically consistent, practical, methodologically manageable or politically acceptable. The goal is to convert the "unthinkable" into something thought about, and address the "impractical" by means of new policy issues and measures.

/Table I

TABLE I
SYSTEMS AND ENVIRONMENTS

<u>Systems</u>	<u>Environment</u>	<u>How to expand system boundaries</u>
That part of the universe that is of particular interest to us in a given context	That which is irrelevant	Incorporate new variables, representing what was previously uninteresting
That part of the universe which is potentially subject to effective control	That which is constant or imperative	Extend reach of potential control to new areas
Those factors which are circumscribed by individual decision-making (e.g. behavior of a single firm), and for which the individual directly suffers the costs involved	Those factors which imply costs to the community, or for which the "free rider" problem arises	Internalization of externalities
Same as 3	Same as 3; the factors also are characterized by the community as susceptible to degradation and as worth saving (i.e. the degradation is unacceptable)	Same as 3
The structure of production and consumption of material goods and services	Factors of "quality of life" beyond the structure of production and consumption	Same as 3; environmental impact studies; incorporate the entire raw materials-final consumption chain
Same as 5	Natural resources, especially those which are non-renewable or scarce	Planning for the use of natural resources, or substitutes
Economic growth factors	Qualitative or social factors	Adoption of a "unified approach" for interdisciplinary studies
Ecosystems	Residuals (outputs) which are not reabsorbed as inputs into the system, where inputs are finite (i.e. limits on the "carrying capacity" of the earth)	Ecoregional development; or more careful technological selection and displacement; or holistic approaches
Same as 8	Same as 8; plus concern more equitable distribution of costs and benefits	Same as 8; and lower consumption of rich countries; or more transfers to poorer countries
Environmental system	Social, political and psychological factors which impede implementation of techno-economic solutions	Elaboration of new political structures or strategies

Challenges are encouraged against existing goals, qualifications, paradigms, agreements, discipline or organizational boundaries, etc. The answer, then, at this level, is the instrumentation of a constant process of creating new environmental problems and of system boundary expansion.

Several comments are in order about this. Even in carrying out a single decision or study, the boundary limits between system and environment are usually approximate and in constant evolution. When the variables are chosen, the joining of them in hypotheses, and the integration of the hypotheses in models, gives a content to the whole (hypothesis or model) greater than that or less than that of the variables taken individually and summed. Also, only in highly restricted (and thus mathematical) sciences, as opposed to more configurational sciences, are the measures and data for the variables likely to be sensitive to (i.e. controlled for) the system boundaries exactly as these have been defined in principle.

Besides the flexibility which characterizes the system/environment boundary, these are many perspectives regarding the "environment" pertinent to the "system". There are environmental factors which are presently latent or potential; other are kinetic or operational; the perceived "environment" may not coincide with the potential or operational environment; nor the inferred "environment" with the perceived "environment"; the valued "environment" is that which is recognized as important by interested parties (and thus as an environmental problem); and the packaged "environment" is that which is proposed for inclusion in or transfer to the system. Information about the environment might be ascribed to any of these levels of subjectivity, and may be reduced to symbols of modernization which can misconstrue more than inform. "Cybernetics", "oil crisis", "land reform" and "pollution" are such symbols. These symbols often then come to label new systems (the environmental problem becomes a system problem), which in turn are the reference points for later issues or environmental problems. It is a never-ending process.

Are these excursions into the "environment" to choose and pick up new variables and values for our "systems" always to be encouraged? Is more chaos in systems analysis necessarily better, since it means a faster turnover of variables? Are we to make a general statement that scientific revolution and cultural upheavals are "good"? Or should we withdraw from such

/an anarchist

an anarchist conclusion, and set out some highest value for **rating** or ranking environmental problems; and a classification of the variables related to the problems?

For the purposes of this paper, we will bypass this problem, simply considering information strategies which generally promote system boundary expansion of the types indicated in Table I. As will be explained, the implementation of such strategies inherently means the formulation of a new development style.

Strategies will also be considered for more specific environmental concerns. These are issues which are subject to public attention at a given moment, and thus of case studies of the expansion of system boundaries. These problems include human and natural stresses on the natural habitat or alterations of material-energy balances which lead to environmental degradation, and conflicts between the maturing or succession of ecological zones into states which assure greater resilience, stability and recoverability and the economic development and productivity of these zones.

The general information challenges regarding these environmental problems are the generation, organization, access and utilization of data on natural resources, development projects and technologies; the emerging integration of the data on the physical environment with socio-economic data; and the reclassification of existing data and documents so that information related to contemporary environmental problems may be detected and retrievable.

C. Development styles

The process by which environmental problems become discussed, and resolved or repressed is a part of the development style of a country or other political division. The style consists of a large number of interrelated components, each of which is characterized by different stages or patterns of change. These components are indicated in Graph 1 and Table 2, which also indicate the different levels of rule-making in and for the government, and the impact of the development and governmental policy outputs on the system/environment.

The existing major development styles are challenged in different epochs by an ascending development style.^{3/} Thus the ascending development style /is not always

is not always the dominant style in a country at a given time, but rather a tension exists with the other major developing styles. The ascending development style in Latin America is the transnational development style, as described in Table 2.

Different styles depend on the initiative and efficacy of different political actors. The transnational style is sponsored and maintained by the transnational community (characterized by the ownership of the means of production and the top managerial, financial, professional, and bureaucratic positions, and by the possession of a specialized knowledge which they have convinced other sectors to be indispensable for innovation and production) 4/.

The hypothesis has been strongly stated that variations in development styles may have significant effects for the "environment"; this statement could approximate a redundancy or circular argument depending on how "environment" is defined. It is our preference to divide this into two separate questions: (a) whether or not a variation in development styles has or is likely to have a significant effect on system boundary expansion; (b) whether or not such a variation would have predictable effects on the resolution of certain key contemporary problems.

In this paper, the focus is on information structures and strategies, and we consider these to be vital elements of the development style, and the development style (and in particular, its information element) a determinant (among others) of the degree and rhythm of system boundary expansion.

Specifically, the contemporary structures of information supply in Latin America are an integral and consistent (although not necessarily very efficient) part of the transnational development style. In particular, the information systems of region are designed to reinforce the relative advantage the transnational community has as information sources/users, and tend to favour increased technological dependence by this region on other regions.

/GRAPH 1

GRAPH 1

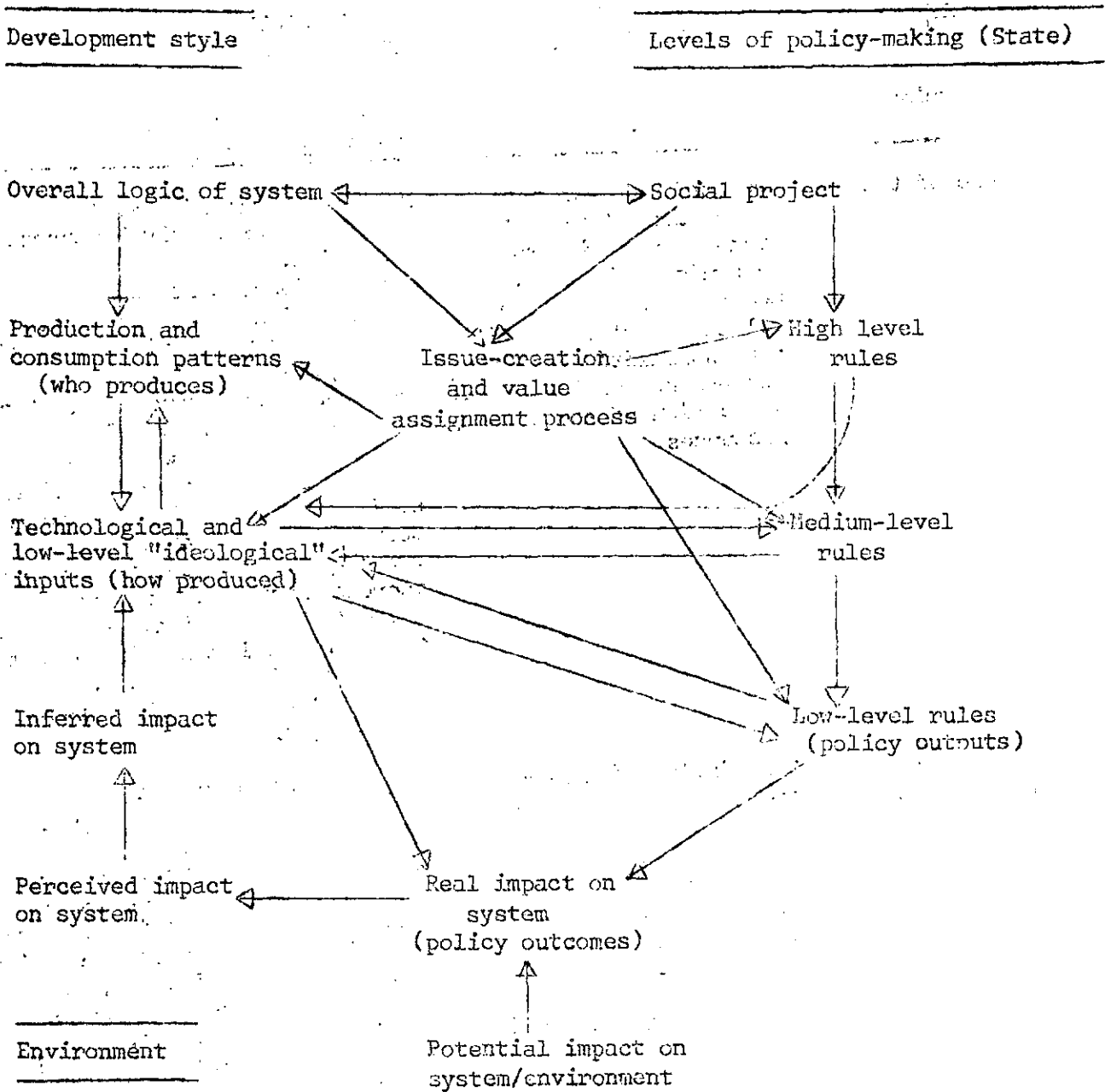


TABLE 2

COMPONENTS OF THE DEVELOPMENT STYLE, AND PARTICULARLY THE
TRANSNATIONAL DEVELOPMENT STYLE, AND OF GOVERNMENT RULE-MAKING

Components of development style	Definition	Example: transnational development style
1. Overall logic of the system	Ownership of means of production. Role of the state in relation to economic activities. General rules for the allocation of production responsibilities, determining production levels and allocation of scarce resources	Monopoly capitalism, state capitalism or highly bureaucratized socialism. Transnational culture. Organizational planning instead of market for relating production/consumption. Preference to regimes which favour professional control of specific policy areas, and with the capacity to divert or absorb the political claims of newly mobilized groups. Sequential and incremental payoffs for the most articulate sectors, increasingly using inflation as an allocation mechanism. State policies decided largely in consultations of selected groups. Dependent development in the semi-periphery areas.
2. Process of defining issues and assigning values	Most influential groups (power elites, development agents) in defining environmental problems. How environmental problems are handled in the different levels of subjectivity. Rules of technology assessment and selection	Transnational community. Professionalization as a group political strategy. Selected environmental problems are packaged, as are determined solutions, and disseminated first as symbols of modernization. High degree of specialization, plus some interdisciplinary work, in problem-solving, with organizational goals and paradigms very important in selecting technologies and projects
3. Production and consumption structure	The structure of income distribution and demand for goods and services. The leading production sectors, in terms of linkages.	Replication of structure of more industrialized countries, where these latter do not succeed in imposing the principle of economic division of labour. Emphasis is on middle-class consumption, infrastructure development and luxury goods, in this general order, although postponement of the first of these is often advocated. Transfer pricing.

TABLE 2, continued

Components of development style	Definition	Example: transnational development style
4. Technological and low-level ideological inputs	The variables of the systems, and the ranges of values considered generally acceptable for these variables. Production techniques and evaluation measures.	Organizational accounting (particularly formal accounting and budgeting, as opposed to cost accounting) determines the most important variables. Laboratory and statistical results and the technological capabilities of high-level technologies, largely determine the ranges of acceptable values. Social factors are important, as long as they do not displace or conflict with the others already stated. The State may accumulate a deficit balance on its accounts, but decision parameters still are mainly those indicated here.
<u>Levels of governmental rule-making</u>		
1. The national or historical social project.	The general models of development which is adopted, indicating the general set of objectives or values of the most powerful sectors as a guide to government action or inaction.	Greatest emphasis on economic growth in rather narrow terms. Considerable decentralization of decision-making among productive and social sectors, using "planning" as a symbol of support coherence. United States' governmental administrative patterns, and especially service and production techniques, generally serve as a model.
2. High-level rules	The general issues publically debated regarding governmental action or inaction	Among such issues are: public/private ownership, inflation, energy/dependence, acceptable debt levels.
3. Middle-level rules	Governmental policies at the sectorial or organizational level, guiding general budgetary decisions.	Policies which promote consolidation and linkages of economic activities. Social programs which are necessary for social/political stability. Patchwork techniques in State economic interventions, including State subsidies, for decentralized or private economic activities.

TABLE 2, continued

<u>Levels of governmental rule-making</u>	<u>Definition</u>	<u>Example: transnational development style</u>
4. Low-level rules	Specific policy outputs: regulatory and allocative decisions of governmental agencies.	Although there is considerable diversity here, the transnational community does interchange very influential points of view about generalized solutions for specific problems.

D. The present structure of information supply in Latin America, an element of the transnational style.

The need to obtain and organize data and documents on contemporary environmental problems in Latin America is obvious. A rather naive approach would be to compile lists of these information requirements, not taking into account the existing technical information on the problems which exist in the region to organize this technical information. Such sporadic information-gathering only adds to the stresses on the material-energy-information balance and to the problems of satisfying the multiple uses of technical information. An environmental information strategy would more logically consider the implications of any new data-gathering and information-handling effort for community problem-solving and the efficient displacement of resources. This means that the attempt to redress environmental information deficiencies should come to terms with the present relationship between technical information problems and the transnational development style.

In this section, it will be argued that the modern information systems in Latin America are consistent parts of the transnational development style. Nonetheless, it is clear that these systems are not as efficient as they could be in satisfying the information requirements as these are defined by the transnational community.

A complementary argument is that any attempt to modify the predominant development style will have to deal with the present information structures,

/and the inherent

and the inherent biases of these structures. Just as it is obvious that the production and allocation of other basic elements of any system/ environment, such as energy and materials, would need to be re-programmed in a manner consistent with the precepts of any alternative development style, it should be evident that the same would need to be done with regard to information.

These arguments will be sustained, following four hypotheses:

1. There are serious general deficiencies in the supply of technical information in most Latin American countries, and the national efforts to resolve these deficiencies give considerable preference to the transnational community as information source/user.
2. Information strategies are carried out in the region, selecting sources and technologies which only compound the problem of too much data which are not useful or which do not justify the costs of their handling.
3. These strategies are often biased to transnational cultural values, rather than related directly to local circumstances and development objectives, in the selection of materials and the classification of these materials.
4. The organization of international information networks promotes technological cooperation within the transnational community, but there are some problems which limit the effectiveness of these networks.

(1) Deficiencies in the supply of technical information, and national efforts to overcome them.

There is a serious information impasse in the Latin American countries, which are not able to make significant progress to organize, conserve and make accessible the mountains of data which are produced and which arrive from abroad. While this impasse affects all potential users and sources of scientific, technological and socio-economic information (which are practically all persons of school age or older), the major attention is given in the Latin American countries to the resolution of this problem for a proportion of the more formally educated population -- especially the national members of the transnational community. Expenditures by the public sector on technical information flows in Latin America greatly favour this community.

/The major users

The major users of technical literature are two groups within the transnational community. One of these is the concentrated group of specialists, especially researchers, in the "centres of excellence" on different subjects, dispersed in the region. Some of these centres do have substantial budgets for acquisitions of bibliographical materials, and promote constant updating by their professional employees. Another group is that which has received professional training abroad. 4a/

Apart from these groups, not even the size of the professional or university-educated population is a fair indicator of the number of regular users of technical literature. Excepting the intensive information user groups mentioned above, the tradition is strong to consider oneself content with the university or other degree obtained as a symbol of being "educated" and to rely on colleagues (due to convenience) or institutional superiors (due to the obligation of working conditions) for technical information acquisition. 5/ There is limited education of students in the use of available information sources, and university libraries receive a very small allotment of funds assigned either to education or to information system developments in most Latin American countries.

For the users of technical information who make the effort to gain access to useful materials, a serious information system impasse is common in Latin America where efficient documentation services should be provided. In a single country of the region, it was discovered that few institutions purchase bibliographic materials on a regular basis; a very small proportion of the working librarians know how and attempt to buy or order documents from abroad; the small amount of training which has been offered (in the Library School and in a basic audio-visual course for librarians) to librarians or library students on acquisition has been over simplified as regards purchasing procedures and gives cursory treatment to the other means for obtaining materials and developing collections; local booksellers are unrealistic and charge very high commissions; there is a tremendous amount of red-tape in obtaining approvals of the foreign exchange and the purchase itself; there is no real continuity of subscriptions; the funds obtained sporadically from one or another international agency or other donor contribute to

/expensive,

expensive, incomplete, poorly-handled and jealously-guarded collections; and the inventory of available national statistics and national bibliographic control are very incomplete. This somber picture, in which information centres are more stockpiles and cementeries of information than efficient processors and disseminators of information, is common in many, but not all, of the countries of the region.

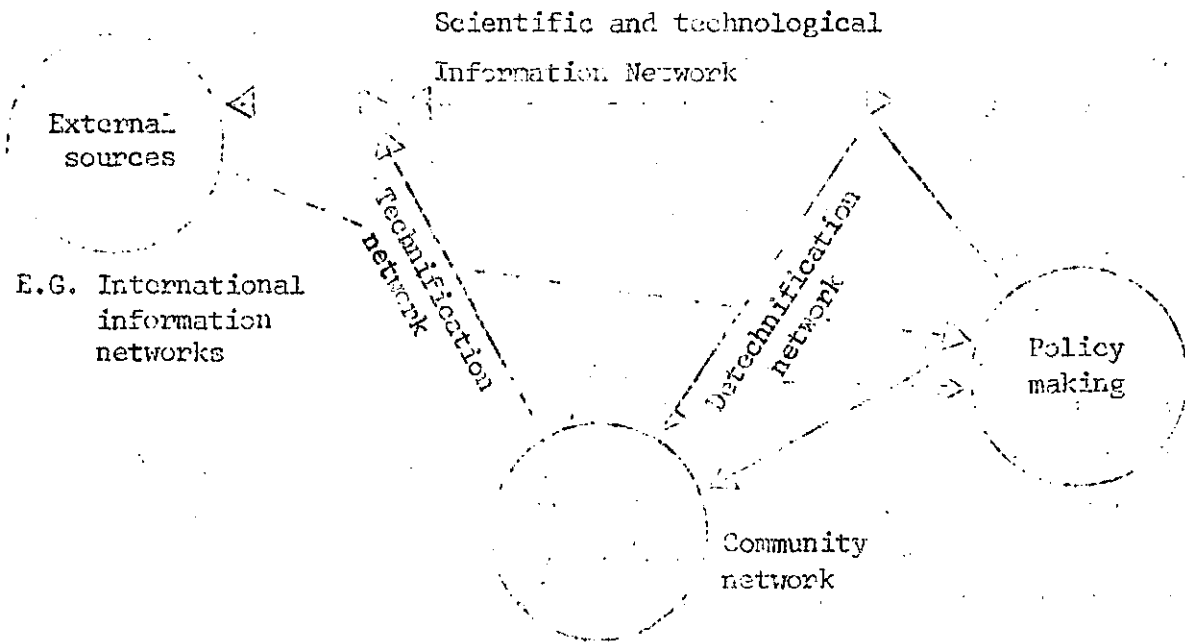
Despite these problems for the interested and active users of technical information, the circulation of such information in Latin America distinctly does favour the information sources/users of the transnational community. Reference is made in this regard to Graph 2. Input into the scientific and technological information network comes from a "technification" process of information generated on the basis of field experiences (at the level of farm, community, factory, school, etc.) and from such external sources as international information networks. It is common for governments and international organizations to finance considerable activity to assure these inputs: research and publication of field studies, linkages to external information sources, technical assistance, transfers of technological information, etc. Also there is relatively ample financing to reinforce communication nationally among scientists and professionals, at least in a few sectors (agriculture, industry and urban planning have received special attention in Latin America).

Some investments are made in a "detechnification" of this information for use by policy-makers or by the ultimate sources/users of the information: the general productive population. These latter groups each have their own information networks; the policy-makers relying largely on a internal distribution of information which is rapidly labelled "confidential", thus increasing its value; the general population relying on word-of-mouth and local communication leaders.

The additional information received by these groups usually needs to be "detechnified" in several senses: (a) Transfer from one medium (e.g. publication, technical report) to another (e.g. radio program, demonstration, brochure); (b) Translation from one language (e.g. English, Spanish) to

/Graph 2

GRAPH 2
INFORMATION FLOWS



another (e.g. Quechua, Aymara); (c) Simplification and interpretation; (d) Selection of the most relevant materials; (e) Development of incentives and skills by the general population in order to be able to understand and apply the information. While there are many groups and institutions (churches, volunteer groups, teachers working overtime, technical institutes, radio stations, field extension stations, etc.) which participate in these detech nification activities, it es very rare to find, in the region, a coordinated and determined effort to put the available technical information in the hands of the mass of people who are in closest contact with the means of production in the countries. This is the weakest link of the technical information flow, involving the greatest misapplication of energy and resources.

There has been considerable interest in dealing with the deficiencies of supply of technical information, in Latin America, by organizing national scientific and technological information systems. In Argentina, Chile, Colom bia and Mexico, among others, the national information systems have historical ties to the university system and are presently dependent on the national science and technological agencies (the CONACYT). 6/ This has meant that the national information system is dependent on the importance which the science and technology agency gives in the moment to information strategies, which unfortunately in some cases has been decreasing in recent years. These national systems tend to concentrate on bibliographical materials, giving rise to other nationwide systems for other types of scientific, technological, educational and socio-economic information.

Other Latin American countries, including Bolivia, 7/ Guatemala, Jamai ca and Venezuela, have shown interest in national information systems which are more encompassing for all types of scientific, technological and socio-economic information.

Thus far, these national systems have reinforced the relative preference given to the transnational community as information users/sources. Much more has been done to technify information and interchange information among members of this transnational community, than to shorten the round-about manner (Graph 2) by which information originating in the general community is disseminated among those who can apply it rather immediately.

/This is most

This is most prejudicial to the general community in two ways. First, the impact of system boundary expansion ("environmental impacts") is often most severe on the poor. The poor are especially vulnerable, and a great part of this vulnerability consists of the lack of information.

Second, collective schemes of abatement of environmental problems require an efficient information system at the community level. The principle of local problem-solving is contradicted by greater investments in studies of the local problems by outsiders than in simple mechanisms to process and analyze within the community the information on the problems.

The preference for the transnational community of information sources/users reflects an unfortunate presumption that one or another group has a monopoly on technological knowledge and innovation. Knowledge of technologies (as well as of techniques) and potential innovation exist in all places and levels, and are all too often systematically unrecognized, unnurtured and in fact discouraged. These can be found among production line or service workers, technicians, engineers, scientists and other professionals. It has not been demonstrated that the potential innovations among one of these groups is intrinsically more valuable or useful to the society than the potential innovations of other groups.

The national and specialized systems implemented in Latin America are not only biased towards the transnational community, but also often give a great deal more attention to the organization of materials from the more industrialized countries than to national and regional materials. None of the Latin American countries has succeeded in assuring bibliographic control of the national production of technical reports, cartographical materials, films and recordings, project studies, as well as general literature and academic studies, originating in those same countries. Much of this patrimony is more complete and better organized in archives abroad. Nor has there been continuous updating of inventories of data collections and flows, so that there is a low level of awareness about existing numerical information. Each institution in the countries acts completely independent in dealing with its information requirements, with the exception of the unwieldy and costly

/large-scale

large-scale data banks which incorporate rather superficial data from many sources.

(2) The problem of selecting information sources and technologies which produce really useful results.

Much is said about the difficulties of controlling the "information explosion". As much could be said about an "explosion" of information system developments, particularly of document sources and technologies.

With an increasing variety of sources and technologies to choose from, the expectation is created that an information strategy can be tailor-made to meet a very wide number of requirements. Surprisingly, Latin America is submerged in a great deal of data which are not useful, or do not justify the costs of their handling, and continues to purchase at great cost information technologies and access to information sources which are not adequate for the most pressing needs. In great measure, this is a reflection of technological dependence on information system prototypes which are alien to Latin American reality, and in part it is a reflection of certain biases of the transnational community which sponsors the transfer of inappropriate information technologies. 8/ In part, it is due to certain common technical design deficiencies (for example, in the development of computerized data bases and subject bibliographies) which lead to information products as difficult to use in more industrialized countries as in the developing world. 9/

The design of information strategies in the region reflects an over specialization in terms of types of information (archivology, library science, computer science, statistics, communication) and subject matter (agriculture, social sciences, geology, etc.), resulting in the tendency of each specialist to stress certain data qualities and ignore others. Biblioteconometric and other measures have been developed regarding some qualities, such as relevance, coding/decoding and obsolescence of information, but very few information specialists are acquainted even with these. System design is carried out normally on the basis of some very dubious premises, of a superficial specification of user requirements (sometimes derived from user studies, which tend in practice to suffer from many

/methodological

methodological errors and limitations).

The result of overspecialized design is an information system which can be very costly, delivering information of low accuracy, excessive quantity, considerable redundancy and relevant in a general sense but not really addressing the parameters of the problem-solving which the information is intended to facilitate.

This design often is entrusted to outsiders, which leads to a serious discrepancy: while information specialists in Latin America often receive poor recognition and pay, leading to considerable turnover, executives are prone to contract services of expensive consultants (especially foreign consultants) to provide data and set up information systems, often with overly sophisticated data-processing equipment, or with equipment for which software adequate to the needs is not available. A cycle of technological dependence is maintained, given the lack of prepared local personnel and the usual necessity to make considerable adaptations of the transferred systems. In setting up these systems, inadequate attention is given to the reliability of the data which will be processed (so a fortune is spent on handling data of most doubtful value), to the possibility that existing systems could be adapted easily to meet the new requirements, to avoiding that existing information centres become strong points of resistance to the new systems, to the importance of adopting standardized classifications and codes apt for national realities and development goals (although some countries have commissions working on this) and to setting out institutional (rather than personal) criteria of confidentiality for assuring access for those who need the information.

Members of the transnational community sponsor the development of such systems, with more emphasis on quantity and automation, and their own direct control of the system, rather than the usefulness of the product for detecting and resolving the real problems of their society. The transnational community is thus a victim of its own marriage to symbols of modernization, rather than to the substance of development. They participate in information strategy which guarantees that their knowledge

/of their environment

of their environment can only be superficial. And the costs can be excessive: a semi-automatic (TERMATREX) system of retrieval can be as effective as a mini-computer system, for 1/20 of the cost.

All the foregoing should not be construed as a blanket argument against automation. Computer programming innovations (including compression techniques, like hashing, which allow the storage of considerably more information using less memory space), the revolution of the "chips", remote sensing, and other technological advances allow the acceptance of a rich variety of computerized system specifications, combining the advantages of individualized information access and large scale data bases.

Computers may be used to permit access to a data base by a large and varied group of users, thus popularizing information retrieval, even though at present the implementation of automation often functions to close off access to persons and groups. Also, the upward tendencies of publishing costs and the downward tendencies of computer processing, CRT terminal and telecommunication costs, mean that on-line computer searching of information will increasingly enjoy cost advantages over manual searching, although there are certain conditions in developing countries which must be weighted in making such cost comparisons.

The point is that the choice of technologies needs to distinguish between the ordering and organization of data for easy retrieval, which can be done by manual as well as automated means, and the specific advantages of the computer. The following statement from the United Nations' publication, THE APPLICATION OF COMPUTER TECHNOLOGY FOR DEVELOPMENT, is a case in point,

"Perhaps the most important aspect of computers is that in the course of introducing them to carry out a task, people are brought to reassess the whole way in which the task should be done. In fact computers often leads to a re-evaluation of why the task is being done". 10/

This "most important aspect of computers" can usually be done without the expense of the computer, unless this machine is necessary to make the needed impression on the affected persons for political reasons.

(3) The transnational bias of the information content and classification.

The dissemination and retrieval of information require its classification, and ordering. The classification determines if the user can gain access to the information in terms which are familiar to him or her, or which are reasonably related to the problem at hand for which the information is being obtained. The ordering determines the efficiency by which this access can be carried out, whether it is an ordering of data in a data base or the ordering of books on the shelves of a library.

The classification and ordering can be made using many different criteria. 11/ Commonly, for statistical data, indicators are used, and for documents, subject headings or descriptors of the content of the documents are used. These tools will influence the questions which user make to the system, and thus the ideas used to conceptualize their projects and decisions (this is called the process of "question negotiation"), and in turn these tools reflect ideological biases about the problems being studied and the questions which it is "appropriate to ask about such problems.

This ideological bias is even more evident in the selection of information for the data base or documentation centre. All books, statistical charts, and other documents place emphasis on some variables and values, and not on others.

In Latin America, the selection of classifications and content is often biased to transnational cultural values, rather than related directly to local circumstances and development objectives.

The bias operates at many different levels of information transfer and system design. It is the definition and categorization by the transnational community of the problems of the region, highly influenced by paradigms shared internationally by professions and by concepts emitted by international organizations of financial and technical assistance, which largely determine which documents have the widest distribution in the region and how these documents are classified.

The transfer of technology brings this problem with it, in a very subtle and effective manner. A technological investment results not only

/in alterations

in alterations in material and organizational production, but in new performance guidelines against which the material and organizational changes are assessed. The technology is accompanied by instructions for its use, by indications of what performance data should be collected, and by a set of performance standards against which this data are to be compared. These data and evaluation systems are transferred directly, through manuals and manufacturer's representatives, or indirectly, through the international professional paradigm which is learned by the technocrats of the recipient organization. They systems point to a limited number of "efficient" or "optimum" uses, out of a total range of possible uses, that a technology might have.

The data and performance criteria indicate to what extent the culture or organization meets modern standards, or has successfully applied the modern techniques. They do not demonstrate whether or not the modernization is suitable or appropriate. The feedback is technique-oriented, not oriented to cultural or organizational purposes or opportunities. It doesn't describe what the culture or organization members and clients experience as a result of the technique. It describes what happens to the techniques as a result of its contact with the culture or organization. There is seldom any search through the experience of the culture or organization for evidence of past attempts to apply similar strategies of organizational or technological change. It is assumed that both a technology and strategies for its implementation are new to the culture or organization. The data and evaluation systems do not help the culture or organization overcome its deficiency of information about its own resources, capabilities and purposes. It only tells where the culture or organization stand in relation to a utopia. The imported criteria of "need", "use", and "competence" are major vehicles for technological dependence.

(4) International information networks.

Parallel to national efforts to overcome the deficiencies of information gathering and supply, is the development of international information networks. These networks have made positive contributions to technological cooperation, but they also tend to favour the transnational community as a user group, and

/to encounter

to encounter practical limitations against information exchange (to and from and sources/users in the Latin American countries) in the full sense of the term.

There are two tendencies in Latin America with regard to the efforts to promote information flows across international frontiers: 1) the initiatives within and through multigovernmental organizations, international professional associations and transnational corporations; and 2) the gradual expansion of national or specialized information services in order to facilitate the access of the clientele to an ever larger number of information sources. 12/

With the first tendency, the emphasis is on the forming of links among different types of institutions regarding information generation, analysis, transmission, dissemination and retrieval. The major objective is to make the international flow of information more intense and efficient, with the tendency to emphasize more its quantity than its quality, or to emphasize world files of specialized information rather than location - specific information. 13/

The general principle of the networks organized by international organizations, insofar as they incorporate materials from many countries, is that each country should index and deliver on its own intellectual production, and get back the information it needs on a cost basis, and should control the selection of what is indexed and entered into the centralized processing center. 14/

Commercial interests in this field operate as if information were like any other raw material on the international market, whereby each country that wishes to participate exports information for processing and can buy back the finished product. The enterprise selects the information, and enjoys a large part of the value added. Sometimes a royalty is paid to a source, but such "sources" are usually rather well-organized data bases or publishers themselves. The firms participating in these ventures will often argue that the information they wish to acquire should be a free-flowing commodity. Transnational corporations are increasingly active in this field, especially in promoting packages of data bases (accessible by satellite) and software. In effect, such corporations act as

/intermediaries

intermediaries between the individual information sources and subscribers. Thus a single service provides to several Latin American countries access to over 70 different data bases in a wide variety of fields.

Academic departments and professional organizations inside and outside of the region also develop information services, with the intention of having a regional or international reach. Access to their products is obtained by subscription or exchange.

The ability of potential users in Latin America, even among the transnational community, to take advantage of these services, is seriously curtailed by a number of problems with this structure of information supply. One such problem is the lack of coordination among international organizations, and the implicit competition between these organizations and commercial and academic institutions, in expanding services. Different standards of analysis, very different retrieval vocabularies, unique entry formats, and worse, the spilling over of the separate developments into a competition in the selection of national counterparts, have occurred. New networks are conceived in order to fill gaps which really do exist, and those developed by international organizations do respond to requests of some governments of developing countries, but the manner by which these networks are organized, the lack of precision in defining their scope, and the overlap between sector- and mission-oriented objectives, all lead to considerable duplication of efforts. More seriously, there is a fragmentization of the scarce human and technical resources in the developing countries that try to comply with their commitments and interest in participating in these networks, and there is insufficient consideration given to the problems of the countries in compatibilizing their commitments of participation in international networks with priority national information needs.

Finally, the tendency of the networks to specialize (in statistics, research, data bases, bibliographies, or other type of information) leaves the user to have the deal separately with different systems for different types of information on the same subject, or to receive only a part of the accessible information which interests him.

/There is another

There is another strategy of international information networks which implies more concern for the relevance and reliability of the information among the countries. This process begins with the organization of an information service for immediate needs of a specific group of users, or subscribers, in a country, or discipline or regarding a particular theme.

Several regional organizations sponsor this type of network development. In addition, there are national institutions which have initiated documentation activities with regional significance. Examples are the Brazilian aerospace research centre in Sao Jose dos Campos, and the Mexican industrial information service (INFOTEC/CONACYT).

These information centres, start with their clientele of researchers and library functions, and gradually expand the number of users and number of channels of access to information. 15/

One problem for these local initiatives is that the region's important experiences on technologies are not always adequately documented. 16/ Information services thus have to concentrate less on bibliographic sources and more on the identification of human resources or projects of potential interest to others.

Another problem is that the local centres which sponsor networks at times adopt ad-hoc forms of vocabularies, formats and services, without a compatibilization (or consideration of "equivalences") with the existing international systems. These services are not able to take advantage of the indexing work done elsewhere, or to offer an efficient access to the document and data holdings outside the country. This explains, partly, why there are so many cases of documentation analysis in Latin America that duplicate that done elsewhere. 17/ This leaves less resources for an intense activity of acquisition and analysis of the documentation which originates in the country itself.

E. Information strategies and environmental problems

Up to this point, a rather somber picture has been given of the deficiencies of the present information system developments in Latin America. Given this situation, what lines of action are feasible for obtaining and

/organizing the

organizing the information needed for the technological assessment of contemporary environmental problems, and for long-run systems boundary expansion?

It should be clear that one cannot expect much by simply adding the demand for "environmental" information to other requirements. At issue really is the relevance and accessibility of information which is collected presently, as well as the filling in of certain gaps.

Thus the consideration here of immediate steps for the meeting of information requirements on contemporary environmental problems is followed by a discussion of strategies which address the longer-term and deeper structural impediments to dynamic and relevant information system developments in Latin America.

(1) Information for contemporary environmental problems.

Among the immediate concerns for meeting information requirements regarding contemporary environmental problems are the access and organization of data and documents necessary for technology assessment of environmental problems, the integration of information on the physical environment with that traditionally collected on socio-economic conditions and the use of frameworks for selecting and analysing the information. These will be discussed here, citing pertinent projects of the United Nations' Environmental Programme (UNEP) and the United Nations' Statistical Office.

(a) Information for technology assessment of environmental problems.

Technology assessment, "as an aid in the identification and consideration of existing and probable impacts of technological applications" 18 can be interpreted in the same broader or narrow senses that we have given to environmental concerns in this paper: problems with problem-solving itself, and the more immediate environmental problems. Here we are interested in the more restricted meaning of technology assessment, as "a broadened but essentially operational analysis of particular technologies defined as concretely and specifically as possible" 19/

The first problem in data-gathering for technology assessment is the identification of the likely information sources. UNEP has chosen to concentrate on improving access to institutional sources of environmental

/information sources

information sources, rather than add one more index to the many partial and duplicate bibliographical reference sources which already exist. Ideally, this referral service (called INFOTERM) will be reinforced and used by UNESCO/UNISIST for identifying, linking and coordinating the many bibliographical reference services which exist. INFOTERM is an ideal tool for this task, given that it recognizes "environment" as covering all subject-matter, it is directed towards putting institutions with similar interests in contact with each other and the comparisons and linkages are made in terms of INFOTERM's classification of contemporary environmental concerns.

Once the most promising institutional sources are selected, these would be contacted for such information as resource inventories, monitoring data, project inventories, technology inventories, technological performance guidelines, and data on abatement costs and "willingness to pay".

Generation of this information suffers the following deficiencies:

1. Resource inventories. A basic problem in Latin America is that we do not know presently how much is documented but not readily accessible. No country in the region has a well-functioning system of bibliographical control or data inventory, and the bibliographies and inventories which are prepared are bound to be extremely incomplete as long as such a system does not exist. There are just too many data generating projects and activities, and too many documents of low circulation and restricted access, for anything less than a massive systematic cooperative effort to be able to detect information resources on natural and human resources. The creation of large public enterprises and "government by consultants" in most Latin American countries has contributed to the design of new information systems of limited access, which contain perhaps the most valuable data existing on non-renewable natural resources reserves, consumption patterns, agricultural production, marketing systems, transport infrastructure, etc. On occasions, these data are better known and more easily accessible to transnational corporations and foreign consultants than to national decision-makers. In the face of the apparent depletion of natural resources in many of the countries, considerable investment is being made in new studies, before organizing and checking the documentation which already exists and is dispersed.

/2. Monitoring data.

2. Monitoring data. In comparison with static accounts of resources, there is less information available on the changes in the state of the eco system over time. The problem is not only one of monitoring, but the merging of files compiled with different techniques or from various sources on the same territory. Considerable work is being carried out to refine the techniques, for these purposes, of remote sensing, ground-truthing, nested mapping, geo-coding and digitization of cartographic descriptions. These techniques, however, do not replace the need to uniformize basic classification categories, in addition to geographical terms, so that the data from different sources can be compared. 20/

3. Project inventories. In Latin America, there is an ever greater centralization of project review, to compatibilize this review with global planning. There have been many problems in making project reviews effective, in the absence of project data retrieval systems. Such systems are now being experimented in the national level in Bolivia, Brazil, Costa Rica, Ecuador and Venezuela. Among the problems of similar systems in the past were the lack of a consistent and practical definition of "project", the lack of specialists with experience in both manual and automatic retrieval systems, the lack of consideration of existing sectorial project control systems (so that the sectors give preference to their own systems rather than collaborate with the national system) and the orientation of new systems towards only one kind of output (bibliographic, catastral, control and supervision, or statistical).

4. Technology inventories. Of special importance is permanent inventory of the technological packages which are introduced into each country. Mexico and the Andean Pact countries have each worked on information retrieval systems for this purpose. The data should include a specification of the components of each package and their terms under which the package has been transferred. This permits the users of these systems (presumably including other Latin American countries) to obtain "the best deal" in technological transfers.

Complementary data bases are those on patents, technical standards,

/commercial information

commercial information (markets, consumer habits, documentation required for exports and imports, insurance and transport availability, etc.) At the present time, the planner or industrialized must recur in most Latin American countries to a wide variety of sources of information on the different aspects of a technological innovation and the feasibility of its production. Peru is an exception, where INTINTEC consolidates these types of information in a single reference and retrieval service.

5. Performance guidelines. Particular care is needed to separate the evaluation criteria (i.e. the information that accompanies a technology, indicating its "proper" applications, the complementary technologies and activities needed to make it work, productivity goals and performance criteria, maintenance and replacement schedules, etc.) from the hardware or core aspect of the technology. Each country needs to set up a data base of performances of technology in that country, to be used as an alternative to standards which are elaborated in other environmental or institutional conditions. This information is vital for the selecting of technologies, for the evaluation of the operating costs and adequacy of existing systems, for more appropriate values for cost-benefit calculations and for setting standards for labour productivity. Having access to this "home-grown" information can be one of the most subtle yet effective methods of alleviating technological dependences.

6. Data on the real abatement costs and "willingness to pay" or collaborate in the solution (abatement costs) to an "environmental" problem. The cheapest alternative regarding abatement of an environmental problem, and thus the "optimal level of pollution" (where damage costs equal the abatement costs), may be modified when public preferences ("willingness to pay") are taken to account. In Latin America, there have been some studies on public perceptions of environmental problems, but in most cases, the solutions are those which address the "environment" (i.e. the newly incorporated part of the "system") as perceived, inferred and valued by key decision-makers.

(b) Data integration.

There are a multitude of problems involved with the integration of site/time specific data on the physical environment with more aggregated

/socio-economic data,

socio-economic data, and these may be the most immediate impediment to the incorporation of contemporary environmental concerns in national planning (rather than being relegated to a secondary or separate planning activity).^{21/} These problems include the following: (i) natural cycles of events do not coincide or nest always with production, consumption and other economic cycles; (ii) conflicting spatial boundaries for collecting data are implied by ecological zones, areas of differentiated cultural or human stresses upon the environment and political/administrative divisions; (iii) the recoverability of an ecosystem in the face of cultural or socio-economic stresses may be related to the history of exposures to such stress before data have been collected for that zone; (iv) the separate "causes" of stress are very difficult to isolate, since stresses may combine to multiply or offset their respective impacts or there may be a functional redundancy among species or factors in an ecosystem; (v) time discounting of environmental assets often does not make sense, especially where permanent loss may occur; (vi) there is no general agreement as yet regarding the most adequate measure (i.e. baseline data) of ecological "health" and whether or not there is a necessarily inverse relationship between such "health" and economic productivity; (vii) the models used for organizing environmental data should be modified to show the redistribution effects of the processes being monitored; (viii) cultural or socio-economic stress may occur in a different time period or geographical space than the environmental impact resulting from that stress; (ix) the data might have to be collected differently if the human activity on the environment is being traced rather than the impact of environment on human potential; (x) environmental data tend to be originator-specific (i.e. collected differently by each monitor or source) rather than user-specific (i.e. assimilated from a variety of sources to derive meaningful comparisons); and (xi) national statistical offices are not used to handling physical environment data from monitoring equipment and laboratories and often do not have linkages with the agencies that produce this data.

Work is underway to identify environmental relevant statistical series from existing demographic and socio-economic data bases. In addition, user-specific needs for environmental plus socio-economic data are being defined.

/In this regard,

In this regard, Friend has delimited the following policy responses to statistical detection of environmental stress: (i) modifying the processes of production and consumption with the intent of reducing environmental stress; (ii) modifying the level of the stresses themselves; (iii) conservation, protection or exploration of environmental assets. 22/

(c) Information frameworks and models.

Some experts have arrived to the conclusion already that it is unrealistic to try to develop a single framework which encompasses environmental statistics. Yet it is also unrealistic to collect environmental data without a conceptual underpinning. There continues to be a search for frameworks which are specific enough so that a consistent and realistic selection of data can be made, and general enough so that the data which are organized in these frameworks can be used to test and compare alternative explanatory models.

The utility has been questioned of such simplified approaches as the division of the environment into land, air, and water categories, or the characterization of the ecosystem in terms of major energy and nutrient flows.

The widespread use in Latin America of a national accounts framework for the integrating of otherwise disperse statistics, means that the inadequacy of the System of National Accounts in covering contemporary environmental concerns is especially pertinent. These concerns are included implicitly or not at all, and there is a problem in sorting out "goods" in national accounts and "bads" from the point of view of environmental degradation. As Anthony Friend has pointed out, "The essential paradox is that most costs attributed to degraded environments contribute to the growth of GNP". 23/

Several proposals have been made, such as introducing "damage function estimates", altering the inclusion of determined values in the GNP, and the development of a physical analogue of the economic accounts. Conceptualization of economic transformation as physical processes requires a prior definition of the physical/chemical transformations or general sequence of processes to which the different commodities are submitted. Work is now underway on a "process dictionary" for a material-energy balance statistical system (MEBSS).

/Frameworks of this

Frameworks of this type require the consideration of a large number of variables, the (usually simplified) interrelating of these variables in terms of cause-effect linkages, identification of the functions and value-added assumed by each component of the model, and the pinpointing of the energy losses. The major information problem is deriving a consistent set of indicators for which reliable data can be found.

Finally, the stress-response approach for environmental statistical organization is (compared to the MEBSS), a more informal accounting system which intends to incorporate relevant series. Stress is considered as any major cause of environmental transformation which is "basic" (i.e. such that all such transformations may be explained by one or a combination of the basic stresses). These stresses play on key "activities" which can be inventoried, may be measured in quantitative terms ("stress measures"), and generate natural environmental responses which may also be measured, as well as specific human (individual or collective) responses which may be expressed as policies. This framework sets out categories of statistical requirements for environmental predictions and controls. If the "activities" could be ordered in a process dictionary, nutrient or energy flow, or a similar chain, this approach would be useful for relating both research and continuing statistical results to policy information requirements.

Even if the problems for data integration were overcome and the information requirements of these frameworks were met, serious limitations would still exist for an adequate response to environmental problems. First, a much more revolutionary approach to the organization of socio-economic and environmental information organization would be necessary if we wish to detect (and respond to) the political-institutional factors which determine the production-consumption patterns; that is, to get at more basic roots of the environmental stresses. Building upon presently available data sets is not enough.

Second, all of the foregoing presumes that technological assessment of environmental problems, and the policy responses which follows such assessment, are basically an elite activity. For popular consumption and response, environmental problems have at times been summarized in the form of "quality of environment" indices, which are more reflections of one subjective

/statement about

statement about what is or is not desirable. Meanwhile, it is presumed that environmental information generally is apt for highly "technified" discourse. The problem of deriving meaningful environmental information flows (i.e. the distribution of information in such a way that community decision-making is enhanced) cannot be so easily disassociated from the search for more meaningful environmental information.

Third, it is presumed that the information for these models is obtainable, under existing political-institutional conditions. ^{24/} Serious doubts about this are suggested not only by the earlier analysis of information problems in Latin America in this paper, but also by the response of the countries of the region to the questionnaire of the United Nations' Statistical Office on country practices in the field of statistics on environment. Most national statistical offices were unable to report on existing data in their countries. The environmental agencies that responded were more informative, but almost always demonstrating limited data even in terms of each agency's decision-making requirements.

(2) Information strategies with broader implications - expanding system boundaries.

We shall now consider environmental problems in a broader perspective: what are the information requirements not only for specific environmental problem-solving but for system boundary expansion in general, and what information strategies are conducive to such expansion?

Conceptually, system boundary expansion involves the assimilation into the "system" (from the "environment") of data of the following five types:

1. Statements of an environmental problem or an "issue" which the system is intended to describe or resolve.
2. Variables; hypotheses which interrelate these variables; models which integrate the hypotheses into a coherent set.
3. Indicators and scales: what to measure in relation to each variable, and to what factors the measure should be sensitive.
4. Values, for the identification or measurement of the status of objects in terms of the indicators.
5. Feedback data: any of the previous four types of data, generated as a reaction or response to a decision, discussion or study.

/At the present

At the present time, there generally exist strong biases among information systems and users as to preferred sources of these data, with more emphasis on elite interest groups, core professional literature and professional colleagues. However, even regarding those types of data which presumably are more precise or "scientific" in nature, factors such as as convenience and habit can weigh more than relevance for the context and objectives to which the data will be applied.

An example of this is the data used in cost-benefit analyses. One economist has described the indicators and values used for discount rates as follows:

"After all, economics has not been able to offer any empirical evidence on the social rate of discount. For the most part, discount rates select value-judgements made by planners. They are no doubt influenced by "fashion"; it is comforting to know that one is discounting at a rate which is reasonably close to the rates other people have used".

System boundary expansion will naturally be severely curtailed, in terms of the possibilities, as long as such biases are so strong.

A rationalization of the choice of information sources and the organization of environmental information for relevant searching would signify a considerable alteration of the information strategies being carried out in Latin America. The primary interest here is information strategies for system boundary expansion in two senses: the utilization of new or different sources of information than those which are used at the present time and expanding the number of participants who are information sources/users.

The following are commentaries on these strategies:

- a. Paradigmatic revolution. The "paradigm" ^{25/} provides a set of reference points for work in a science of profession, and for the interchange of ideas with other sciences or professions. It indicates the range of activities which the scientists or professionals consider to be their own. It is described by a specialized language. It describes what should be done, with what procedures and instruments, and how. It includes shared concepts regarding time, space, valuation and relation. It sets out an area of concern and a map to guide the scientist or professional through this area. He is

/encouraged to

encouraged to explore the shaded areas of the map and to fill in or correct the details. There are usually strong social and political pressures, as well as personal economic justifications, for defending the boundaries of the paradigm by maintaining a certain discipline among those working within those boundaries, and by insisting on prerogatives for those persons with regard to that work. 26/ Discomformities with the paradigm do accumulate, and a breakthrough or "paradigm revolution" takes place.

In a science or profession, the "core" literature and its content (i.e. selection of topics) are obvious indices of the predominant paradigms at any moment of time. The fact that librarians seek to identify the core literature to guide acquisition decisions, is an example of the manner by which information specialists co-participate, not always very consciously, in reinforcing paradigms. 27/ The information scientist shows the same bias when relying exclusively on the users' own statements of their requirements, as a guide to elaborating information strategies or searching procedures, since the users are only able to state what they already know and are likely to place emphasis on what they think they should know.

Information strategies intent on breaking with this tendency to reinforce paradigm literature and concepts in a science or profession, must focus more attention on "non-core" literature, search less disseminated documentation, and sponsor the writing up of ideas and experiences which are not documented. Ways need to be found to open academic journals, including those published in Latin America, beyond the control of limited scientific cliques or trends. Also, reference sources should be designed to cite less-recognized literature from the science or discipline being covered, and literature or reference sources of potentially pertinent literature of other sciences or disciplines.

The most important measure would be a really encompassing approach to detect, index and conserve copies of all bibliographic materials produced in each country, by means of an effective legal deposit and national bibliography system. In Latin America, the tendency has been to model such systems on the United States' Library of Congress. This perhaps is less effective and more costly than a more decentralized approach, such as that being experimented in Bolivia.

/Paradigm boundaries

Paradigm boundaries, also are challenged where an "interactive" relationship is structured (in information reference, retrieval or selective dissemination) between the sources, intermediaries, storage and users of information so that there are rapid interchanges of the sort: "would this be of interest to you?" or "here is an example of one takeoff from the subject in which you have stated interest", followed by, "would you be interested in more of the same?". Setting up a computer terminal is not a necessary or sufficient measure for this purpose. The work on conceptual maps, thesauri and other linguistic devices to aide searching, is important to facilitate interaction. The training of information workers in "question negotiation" with their clientele is the most constructive measure in assuring an interactive system.

b. Indirect influence. A promising strategy to favour environmental concerns in decision-making, is outright subversion of system boundaries, by slipping new criteria into the decision-making process.

This approach was suggested to the United Nations' Environmental Programme in a paper presented by Bolivia, entitled "Proposal for the Regional Organization of the International Referral System (of UNEP) in Latin America". 28/ The opportunity exists for UNEP to influence system boundary expansion in a most effective manner by collaborating (together with UNESCO/UNISIST) in the design and implementation of national information systems. The major contribution of UNEP would be information strategies which favour system boundary expansion (and thus the modification of some of the recommendations of UNISIST in this regard). Not to get involved in this would only allow constraining strategies to continue to be implemented, and to limit the reach of UNEP's own systems.

Of particular importance is the collaboration of UNEP/IRS (INFOTERRA) in the implementation of national inventories of data sources (in Bolivia, the inventory uses a methodology for registering these sources compatible with that of INFOTERRA, but collecting more detailed information on each information centre). This linkage assures the register of institutions work ing on the limits or frontiers of knowledge, and especially on contemporary

/environmental problems.

environmental problems. The description of these institutions is made in terms which permit the international exchange of this information.

A second method of indirect influence is to assure that the indexing and retrieval vocabularies which are used in information systems reflect environmental concerns. The structure of these vocabularies should be sufficiently flexible to allow for the incorporation of new terms, yet sufficiently predetermined to facilitate inter-disciplinary communication. The categories should have "environment" (and not just "system" or paradigm) biases. The leading questions the user would have to use in information searching, would force him to consider environmental problems in relation to the matter he is studying or deciding.

A third method of indirect influence is to promote greater "quality control" during information system design. Information quality (especially accuracy, redundancy, relevance, obsolescence and timeliness) greatly influences the consideration of "quality of life" in decision-making.

A fourth method is to assist the governments in consolidating the patents, standards, commercial and other information which is important for technology assessment, into unified systems. Easy access would encourage greater use of patents, standards and similar literature, often ignored regarding their value as a public source of primary information. 29/ Also, only by pooling this information it is possible to make continuous systematic appraisals of the relationship between technology selections, imports and natural resource utilization.

c. Environmental impact review, ombudsman or environmental adversary. These are measures for the creation in the bureaucracy of countervailing powers to push for system boundary expansion in the name of environment, equal opportunity, budget management, etc. They are much more explicit strategies of calling attention to environmental concerns, than are the methods of indirect influence indicated above. They help to assure that certain biases in public sector decision-making are met by differing points of view.

These measures are limited in their impact, to the extent that they permit "environmental problems" to be isolated from the general decision-making process and to be treated as special cases. They can thus be kept

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on the "outside" of normal discourse. They can bring new and important information to bear on decisions, but their influence can be relegated to a secondary plane. Thus they can be less effective than the methods of indirect influence.

d. Strategies for greater participation in decision-making and access to public information. Information systems either reinforce rigidities regarding "who decides" and "who benefits" in organizational systems and the conceptual systems which define and resolve environmental problems, or they permit and even induce the influence of an ever-broader public on decision-making. Unfortunately, organization theory has been slow to comprehend the importance of information system design as an organizational development method, or the importance of information flow structures in order to sustain other organization development initiatives. 30/ And empirically, the study of information flows, from the point of view of organizational development, is relatively new. 31/

The most limited expansion would be towards team-work and inter-disciplinary approaches among the technocrats. The major information problem here is that of terminological barriers, and this problem is increasing when inter-disciplinary work leads to new scientific offspring (i.e. journals and terminologies) rather than merging or reducing the terminological differences between existing sciences or disciplines. Collaboration between information scientists and subject matter specialists is needed to compile more adequate glossaries and dictionaries.

A similar level of expansion is reached when an effort is made to bring to the decision-makers information which is more representative of public interests. Representation is a process by which something is "made present in some sense while nevertheless not really being present literally or fully in fact" 32/, and information is an important instrument of interest representation. The difficult challenges here are the definition of the "appropriate" clientele regarding any decision, the weighting of the responses of the different members of the clientele, sampling biases in obtaining data on the sentiments and situation of the clientele, and to assure a fair reflection of each clientele's interests.

/Greater popular

Greater popular control or oversight of bureaucratic activities can be obtained by facilitating more direct representation through commissions, committees, advisory boards and hearings. Or technical information, and other information used by decision-makers, can be made more accessible and understandable to a wider group of people, in the following ways:

1. Setting up data centres, like the "answer columns" of some newspapers and reference desks in some libraries, which try to answer all questions related to policy-making and community activities. These generally are set up to help guide people through the governmental bureaucratic maze in locating services or understanding rules for using those services. 33/
2. Coordination of information detechnification activities, in order to broaden the dissemination of the products of these activities (which separately can only reach a limited clientele). Of special importance is a "warning system" of advising people who are likely to be affected by new policies or events, and possibly would want to participate in the decision-making.
3. Elaboration of "leading questions" for users of information systems, so that their questions or inquiries are clearly presented to the data base (i.e. to facilitate the man-machine "question negotiation" process). Some data base software are incorporating the capability for this type of interaction with the user, bringing the data within reach of the most novice user. Reference services in libraries and documentation centres should also prepare such leading questions.
4. Place more emphasis on supply-oriented systems (e.g. data bases) rather than on functional- or problem-oriented systems (e.g. management information systems), so that the systems are prepared to meet a wider variety of contingencies and user requirements.
5. Where there is a relative lack of information on user habits regarding technical information, a supply-induced development of the system may be necessary. Thus the potential user receives, unsolicited, some information based on a profile of that user and a careful selection (and possibly, detechnification) of the information on hand. His

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reactions are studied to determine the actual utilization made of the information.

6. Research is needed on how to make information-brokerage most effective in communities and organizations. It is not clear what social and psychological factors explain the special ability of some people to place themselves at critical points in an information flow and to make themselves practically indispensable as intermediaries. Nor if the personal qualities required for effective information intermediation are compatible with a democratic orientation in decision-making itself. These are very important questions for community information system design.
7. An information measure which is most promising in assuring adequate representation for persons effected by bureaucratic decisions, is "open access". In the United States, a decisive move was made towards a more democratic approach to information-handling, with the passing of the amended Freedom of Information Act of 1974, whereby any person should have clear access to public administration records and the burden of justifying withholding is placed on the Governmental agencies. ^{34/} The public administration should be forced to set out clear guidelines of access to the documents produced in and for the public sector, curtailing the setting by individual bureaucrats of limitations on access.
- e. Appropriate information system technologies and design. Logically, information systems intended to induce system boundary expansion, would be developed for flexibility as to outputs, for assuring information qualities and for taking advantage of economical combinations of manual and automatic features. Mitigating against this are the overspecialization and terminological chaos in the information field.

It is very rare to find a systems' specialist with a completely open-mind about information system technologies. He or she is more likely to be versed especially in manual or in automatic systems, in supply-oriented or functional-oriented systems, and in the technologies which are most closely identified with his or her specialty (archivology, library science, computer science, statistics, etc.). As a result, the

implementation of some urgently needed systems in Latin America (e.g. project control information systems, national deposits and copyright systems, technology inventories, resource inventories) tends to be based on over specialized designs. These systems do not work well.

Latin America, in sum, does not have the most efficient systems possible which are needed to deal with its most pressing environmental problems, in great part due to poor design and selection of information technologies.

Training of information scientists needs to be greatly improved and expanded in this regard. Duplicating advanced technology courses appropriate for a very different information environment, by bringing them from more industrialized countries, is not a viable solution. Much more useful are packages of simplified audio-visual presentations tailor-made for the Latin American information workers. University programs in the information field could be integrated, or joint courses on information system design and policies given for all information departments.

Teaching materials and guidelines are needed especially on the quality-based approach to information systems' design; on information acquisition, so that Latin American information centres make greater use of methods of acquisition other than purchase; on the systematic collection of data on social and physical conditions (non-traceable data) and the integration of those data with the administrative information which is collected traditionally; on the development of indexing and retrieval vocabularies which enhance the retrieval of pertinent statistics, bibliography and reviews; and on the marketing and implementation of services which are geared to the habits and requirements of information users. Only in this way will the pattern be broken whereby information which is not relevant is made available passively to persons who are not motivated. The attack on rigid system boundaries begins with a willingness by persons to use new information.

f. International information networks. As an element of constructive participation by Latin American countries in international information systems, they could propose design criteria for such networks. At least all of the components and processes discussed earlier on this subject should be considered. The sponsors of the networks should have to indicate the assumptions behind the design of the system and the implications of the system for

/technological dependence.

technological dependence. 35/

One of the interests of the countries should be the possibilities of making variations on the proposed systems, or of breaking down the retrieval system packages, in order to assure that the analysis and processing of the information meets priority national needs, as well as meeting the commitments and enjoying the advantages of participation in international networks. However, it needs to be stressed that the standards of international networks are useful, permitting the developing countries to work out a division of work on information indexing and analysis, and that a change of software, equipment, vocabulary or other system component can imply a high cost. 36/

While appraising the best means to participate in these networks at the national level, the Latin American countries could promote a more effective coordination among the international organizations, transnational corporations and academic institutions which sponsor the networks. A reinforcement and standardization of the analysis and processing as well as services, of existing information centres in the region could produce perhaps more benefits, at lower cost, than the implementation of a totally new network. The different international organizations should agree on how to approach the coordination with national counterparts. 37/

Most importantly, the developing countries need to assume a more aggressive role in the design of these networks, and in the negotiation of their participation in the networks.

g. National information systems and policy. The most general recommendation to deal with the information aspect of environmental problems and systems boundary expansion, is the organization of a national information system, which integrates all the information specialities into a single combined effort, and which sets out an appropriate information policy, promotes adequate design of all types of information systems, gives priority to the organization of the information produced nationally, negotiates an equitable base for international exchange of information and coordinates the training of information workers to insure that this training is pertinent to the systems developments needed in the country. Participation in the drawing up of this policy should be very broad, with

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special place given to the agencies in charge of scientific and technological development policy and of environmental protection.

F. Information strategies and the alteration of the development style.

It should be apparent upon analyzing the problems which exist presently for the implementation of the information strategies conducive to systems boundary expansion, that many of these problems can be overcome and strategies undertaken on a piecemeal basis without requiring beforehand a marked alteration of the transnational development style. In fact, the very implementation of these strategies can lead to a weakening of the continuation of present lower-level ideology patterns. But it is probable that the overall logic of the system would maintain itself and the transnational corporations and community would adapt to the realities of having to give more serious attention to obtaining and controlling information. It wouldn't come to them so easily.

The astuteness they have shown in adapting to new circumstances and demands regarding energy sources and materials, would likely be repeated in the case of information. At a minimum, lip-service would be paid to the importance of information as patrimony and a basic commodity. The costs of obtaining it would be increased. More subtle means for controlling it would be exploited.

A systematic implementation of these strategies, as much regarding the tapping of new information sources as the increase of participation in system boundary changes, would certainly reflect a substantial modification of the development style. Only Bolivia and the Federal Republic of Germany have advanced in the elaboration of a national information policy, which if implemented fully, would represent such a drastic alteration of patterns of information control. A lot more controversy than what presently exists would ensue regarding the information problem. It would certainly become a key public issue.

A substantial modification of the development strategy does require an alteration of the predominant information strategies, just as it obviously does require new methods of deal with energy and materials problems. If information is not explicitly incorporated into the development model, it will become the brake to progress.

FOOTNOTES

- 1/ The terminology for this typology has been taken, in large part, from Data for Development International Association; DATA AND DEVELOPMENT, DFD, Marseille, France, n.d., 31-2, 118-21; and Republic of Kenya, Ministry of Finance and Planning, Central Bureau of Statistics, and Data for Development International Association, "The Data Network in the Government of Kenya, Phase 1: Analysis of the Present Situation", Revised April 1977, 8-9.
- 2/ Relevance is often defined in terms of the technical measures of retrieval effectiveness: "recall" and "precision".
- 3/ Several concepts set out here are proposed by José Villamil in a working paper for this project.
- 4/ Osvaldo Sunkel and Edmundo Fuenzalida, "Transnational Capitalism and national development", in José J. Villamil, ed. TRANSNATIONAL CAPITALISM AND NATIONAL DEVELOPMENT. NEW PERSPECTIVES ON DEPENDANCE, Harvester Press, 1979.
- 4a/ One investigation concludes that Latin Americans who have studied in the United States tend to read technical literature, especially of that country, more extensively than their United States' counterparts. Ninety percent of the respondents reported regular exposure to technical journals and other publications.
Paul Deutschmann, Hubert Ellingsworth and John Mc.Nelly, COMMUNICATION AND SOCIAL CHANGE IN LATIN AMERICA; INTRODUCING NEW TECHNOLOGY, 1968.
- 5/ The studies of the National Information System (SYFNID) of Bolivia have concluded that 98% of the medical doctors and health administrators, planners and researchers based in La Paz read or are acquainted with a wide variety of medical journals (with a rather low concentration of titles), but only 1/3 even make occasional use of subject bibliographies (almost all of this group using Index Medicus) and 1/5 make use of the National Documentation Centre's reference and document acquisition services connected through Brazil's Regional Medical Library to MEDLINE. Of a sample population of 40 geologists, only 1 regularly and 9 occasionally consult international subject bibliographies. It is an extremely rare school teacher, among the 50,000 in the country, than even knows about subject bibliographies or professional journals. In these fields, the most regular users of these materials are the small groups of researchers. The other professionals tend to rely on information generated in their own institutions; much of which (except in education) is labelled "confidential". SYFNID, "La geología en Bolivia frente a la problemática de la información. Resultados de un estudio y propuestas de acciones a ser tomadas", February 1979. The studies on the remaining sectors will be finalized during the year.

- 6/ With regard to Chile and Colombia, see Betty Johnson V., "Los Sistemas Nacionales de Información: Las experiencias de Colombia y de Chile", Paper for meeting on information for development in Latin America and the Caribbean, Cali, Colombia, 23-28, October 1977. With regard to Mexico, our major source of information is Antonio Ayesterán; also Myla Goldman, "Technical Information Services in México", SPECIAL LIBRARIES, 69 (9), September 1978, 355-60.
- 7/ Warren Crowther and Gonzalo Riveros, "The Bolivian Approach to the Development of a National Information System", Paper for INTERNATIONAL SEMINAR ON INFORMATION SYSTEMS IN PUBLIC ADMINISTRATION AND THEIR ROLE IN ECONOMIC AND SOCIAL DEVELOPMENT, Chamrousse, France, 17-23 June 1979.
- 8/ Manuel Sadosky, "La computación en el mundo moderno: Realidades y perspectivas en América Latina", AMERICA LATINA; CIENCIA Y TECNOLOGIA EN EL DESARROLLO DE LA SOCIEDAD, Santiago, Chile, Editorial Universitaria, 1970, 98-119.
- 9/ Warren Crowther, "Subject bibliographies of more industrialized countries and problems for their use, especially in developing countries", Paper for INTERNATIONAL SEMINAR ON INFORMATION SYSTEMS IN PUBLIC ADMINISTRATION AND THEIR ROLE IN ECONOMIC AND SOCIAL DEVELOPMENT, Chamrousse, France, 17-23, June 1979.
- 10/ United Nations, THE APPLICATION OF COMPUTER TECHNOLOGY FOR DEVELOPMENT, New York, United Nations, 1971, 14.
- 11/ Especially pertinent to contemporary environmental problems is R.T. Niehoff, "Development of an Integrated Energy Vocabulary and the Possibilities of On-Line Subject Switching", JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, 25 (1). January 1976, 3-17.
- 12/ As a corollary to these two tendencies, there are two general procedures adopted in the region regarding the organization of new information centers: 1) a branch office of an international system or data base, respecting the vocabulary and nature of the services which the headquarters offers; 2) an ad-hoc response to the priority needs of a small group of users, innovating a new vocabulary and methodology or work. The first procedure offers the advantage of an efficient exchange of information with the outside world, at the risk of a low level of relevance of the information for local needs, or a classification system which is ill-suited to local realities. The second option assures a high level of relevance, but with low levels of efficiency by duplicating work carried out elsewhere.

- 13/ "Information Systems and International Organizations", Special Issue of DATA FOR DEVELOPMENT NEWSLETTER, October 1977.
- 14/ Elizabeth Miller and Kate Wild, "A strategy for international information systems", SPECIAL LIBRARIES, 69 (11), November 1978, 435-442. John Woolston, "The importance of international information systems for building national capabilities", INTERNATIONAL FORUM ON INFORMATION AND DOCUMENTATION, 2(2), 1977, 16-21. John Woolston, "International information systems for development", Paper for Meeting on Information for Development in Latin America and the Caribbean, Cali, Colombia, 23-28, October 1977.
- 15/ The publication of a specialized index or abstract can be the basis for a network. One example is the publication by the Latin American Social and Documentation Centre (CLADES) of CLADINDEX, on documents of the Economic Commission for Latin America and other institutions, which is a step towards the organization of DEVSIS (information on development) network in the region.
An exceptional strategy in the development of networks in that of DOCPAL, of the Latin American Demography Centre, which intends to create a demand for its services by means of an ample distribution of information analyses on population problems. This means finding potential users and incorporating them into the system, without requiring their initiative. The possibilities that this strategy will be satisfactory are enhanced by DOCPAL'S large budget and the extensive and continuous contact that exists informally among the region's population experts.
- 16/ This may be explained by the following factors: the desires of private industry to sell its products and not its technology; that the innovators on the production line are too occupied with the implementation of their ideas and do not take the time to document them; and the lack of consideration that the innovations might be applicable elsewhere.
- 17/ Other reasons for this are: (1) the subscription prices of the reference materials are very high and it is less costly to duplicate the work; (2) lack of access in the country to the journals and documents which are cited in the foreign indexes; (3) the vocabularies of the indexes do not lend well to the analysis of materials in terms of the problems and reality of the country; and (4) the librarians are not familiar with the indexes or abstracts.
- 18/ Preamble of the Technology Assessment Act of 1972 of the United States.

- 19/ Francois Hetman, "Steps in technology assessment", INTERNATIONAL SOCIAL SCIENCE JOURNAL, XXV (3), 1973, 257-72.
- 20/ United Nations' Economic and Social Council, Statistical Commission, "Progress report on environmental statistics; Report of the Secretary-General", E/CN 3/521, New York, 4 August 1978.
- 21/ Ibid. David Rapport and Anthony Friend, "Towards a comprehensive framework for environmental statistics: A stress-response approach", Statistics Canada, Ottawa, 1979.
- 22/ Rapport and Friend, 77.
- 23/ Rapport and Friend, 71.
- 24/ Roland McKean, "Some problems of criteria and acquiring information", in Henry Jarrett, ed., ENVIRONMENTAL QUALITY IN A GROWING ECONOMY, Baltimore, John Hopkins Press, 1966, 63. Even if the information were obtainable, the difficulties of deriving and processing and adequate algorithm remain. A GUIDE TO THE THEORY OF NP-COMPLETENESS, San Francisco, Freeman, 1979.
- 25/ The concept of "paradigm" given here is a version of that of Thomas Kuhn, THE STRUCTURE OF SCIENTIFIC REVOLUTION, Chicago, Chicago University Press, 1970. The relation to information systems and political power is studied in Jaime Millan, Gabriel Murillo, Charles Ritcher and Elizabeth Ungar, PODER E INFORMACION, Bogotá, Colombia, Facultad de Economía, Centro de Estudios sobre Desarrollo Económico, 1977.
- 26/ Guy Benveniste and Warren Lichman, eds. AGENTS OF CHANGE: PROFESSIONALISM IN DEVELOPING COUNTRIES, New York, Praeger, 1969; Michael Crozier, THE BUREAUCRATIC PHENOMENON, Chicago, Chicago University Press, 1964.
- 27/ Biblioteconometric studies consistently demonstrate the existence of a "core" literature in each of the sciences and professions, in terms of the number of subscribers and the number of citations to such literature.
This writer often uses the citation indexes, but realizes that such indexes tend to call attention to "core" literature and in some cases explicitly "anti-core" literature, but not "non-core".
- 28/ Presented to the meeting of national focal points, International Referral System, United Nations' Environmental Programme, Nairobi, November 1977.
- 29/ Susan E. Edwards, "Patents: an introduction", SPECIAL LIBRARIES, 69 (2), February 1978, 45-50.

- 30/ French and Bell recognize that "in most OD interventions the client group is assisted in generating valid data and learning from them", and define the differences between "the data-based nature of OD" and "other data-based change activities". Even this limited treatment of the subject is exceptional. Wendell French and Cecil Bell Jr., ORGANIZATION DEVELOPMENT, 2nd. ed., Englewood Cliffs, N.J., Prentice-Hall, 1973. See also "Symposium on organization development", PUBLIC ADMINISTRATION REVIEW, March/April 1974, 97-140; Robert Biller, "Some implications of adaption for organizational and political development", in F. Marinia, ed. THE NEW PUBLIC ADMINISTRATION, New York, Chandler, 1970. An empirical study of the relative importance of paradigms and organization rigidities is: Richard Whitley, "Types of science, organizational strategies and patterns of work in research laboratories in different scientific fields", SOCIAL SCIENCE INFORMATION, 17, (3), 1978, 427-48.
- 31/ It must combine the experience of organization and methods (O&M) in analyzing administrative procedures, of management information systems (MIS) in analyzing decision-making requirements for information, of information theory (coding/decoding and information channel capacity), of archivology regarding document storage and conservation, of data base design of access systems, and of computer programming flowcharting. Information systems analysts seldom have a command of all of these perspectives, in order to interrelate flow analysis which detect and program how the data are disaggregated or aggregated, the sequence of functions applied to the information and the preparation of those who will carry out those functions, and the specification of the entire sequence of products and subproducts of the system and their respective qualities.
- 32/ Hanna Pitkin, "Commentary: The Paradox of Representation", in J. Roland Pennock and John W. Chapman, eds., NOMOS X: REPRESENTATION, New York: Atherton, 1968, 41.
- 33/ Harvey Frauengless, "Environmental Policy: Public participation and the open information system" in Albert Utton and Daniel Henning, eds., ENVIRONMENTAL POLICY: CONCEPTS AND INTERNATIONAL IMPLICATIONS, New York, Praeger, 1973, 86-93.
- 34/ L.G. Sherick, HOW TO USE THE FREEDOM OF INFORMATION ACT (FOIA), New York, Arco, 1978, Chapter I.
- 35/ The National Information System of Bolivia, which has the responsibility of channeling and regulating contracts between national institutions in that country and international systems, networks or exchange of information, has prepared a questionnaire or checklist regarding factors which should be specified very clearly.

36/ UNISIST standards provide a general standard of universal consistency regarding many processes.

37/ Formally, it is the national government which selects the counter part. However, this is influenced very heavily by previous contacts between national institutions and the international organization.