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Alternative view of segmented documents via Kairos

1971

Information Systems and Inter-Organizational Space

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Introduction

Abstract: It is currently impractical or uneconomic to maintain an up-to-date picture of who is doing what, where, and when. There is little systematically ordered information on the organizations and social structures active in all fields of human activity. Organizational space may therefore be said to be unmapped. This condition reinforces program isolationism and traditional forms of contact between organizations and disciplines at a time when social problems increasingly cross established jurisdictional boundaries.

A worldwide information collection system is required which, to be viable, cannot be dependent on any central or over-all administration but which would facilitate interaction between groups which are currently isolated geographically or by specialization. The creation of such a system needs to be catalyzed rather than organized. The technique discussed in the article could well have important implications for communication across jurisdictional boundaries within governmental organizational structures. It raises no immediate technical problems.

Information is not accessible until it has been processed into a form, which highlights points of significance as defined by unknown users. A new medium is required to facilitate more intimate interaction between groups and disciplines, which use and evaluate the same information in different ways. The technique of computer interactive graphics could be developed to provide the breakthrough needed to contain conceptually the recognized complexity of social processes.

In many large organizations and administrations it is currently impractical or uneconomic to maintain an up-to-date picture of who is doing what, where, and when. As an example, a recent United Nations document stated that 'it has become more and more difficult for any individual, whether in government service or in an international secretariat, to be aware of the totality of the United Nations family programme and activities. This in turn complicates the process of coordination, makes overlapping and duplication more likely.' (1) This view was confirmed by Sir Robert Jackson:

For many years, I have looked for the 'brain' which guides the policies and operations of the UN development system. The search has been in vain. Here and there throughout the system there are offices and units collecting the information available, but there is no group (or 'Brains Trust') which is constantly monitoring the present operation, learning from experience, grasping at all that science and technology has to offer, launching new ideas and methods, challenging established practices, and provoking thought inside and outside the system. . . . The UN development system has tried to wage a war on want for many years with very little organized 'brain' to guide it. . . . Without it, the future evolution of the UN development system could easily repeat the history of the dinosaur. (2)

The Current Crisis

The situation at the international level seems to be a reflection of similar problems at the national level.³ One European government commissioned a study to locate all the international bodies in some way affected by development programs, in order to formulate an over-all policy for the period of the United Nations Second Development Decade (1970-1980). Three hundred such bodies were located. The national commission was then forced to abandon its intention because it was unable to locate within its own administration the departments, which could or should be communicating with the international bodies. The over-all national policy finally formulated was limited to thirty bodies, or ten percent of the total.

It is useful to think of organizations as being distributed throughout sectors of a multidimensional 'space' according to the different functions they perform within society as a whole. This may be termed 'function space,' which may also be thought of as 'organizational space.' The structure and properties of this space are complex and closely related to the problems of communication across disciplinary,

cultural, and jurisdictional boundaries. (4) In the light of the preceding paragraphs, organizational space may be said to be unmapped in any systematic sense. There is no general and clear picture of who is doing what, where. Even estimates of the number of organizations of all types within a given country are lacking, with a few notable exceptions. Information is, of course, in some cases available in the form of specialized directories, or of specialized studies on particular groups or bodies, but these sources are themselves often difficult and expensive to locate, obtain, and keep up to date, particularly concerning developing countries. In addition, the value of these sources is severely diminished because it is seldom clear what types of organization have been omitted as a result of the limited category set used.

The clumsy patchwork of data, which constitutes the 1970's map of the active bodies in the social universe, bears little comparison to the thorough manner in which the limits of the physical universe are now mapped. While expensive machinery is deployed to detect the number of individuals, little or no systematic effort is made to detect the complex manner in which individuals, in various roles, cluster together to form larger groupings, or to resolve the problems of matching partial maps made by bodies in different parts of organizational space.

Relevance of Organizational Space Map

The principal focus in the selection and collection of 'social' information has been data on the individual and his physical environment. This is probably due to the fact that social information has had to be derived from systematic data collected for economic purposes.

Although the terms 'economic' and 'social' are supposed to be equally relevant in the development context, in practice, social programs seem merely to be an embarrassment.

The social dimension of development, for example, is generally treated separately from the technical or economic aspects, a dichotomy which results in rhetorical 'social' projects with no bearing on realities, and in short-sighted technical projects with no grasp of the human factor. (5)

This embarrassment would seem to derive from the inability to handle social data in an adequately systematic manner or to relate it to economic data. The economist can justify the collection and use of economic data on categories of individuals and industries to develop a complex integrated picture of the fund and goods flow within a world system. The social scientist is, however, limited at the one extreme to collection of information on particular, relatively small groups and the relationship between them in communities, while at the other extreme he focuses on the formal agreements between nations.

Although the chain of social contacts and organizations which nests the small group within a framework of international contacts is known to exist, it does not appear to have been explored systematically. Typologies exist which cover the whole spectrum (6) but data have been collected only on particular parts of it which it has not been possible to juxtapose-possibly because of the diminution of interest of a particular social science discipline outside particular bands of the spectrum. (7) The effort has not yet been made either to relate different modes of transnational activity or to relate transnational links to local activity.

The search for adequate social indicators seems to be restricted to measures of the quality of life in welfare terms. Economic man has been conceptually set in a box, into and from which there must be certain equilibrium flows of goods, funds, and work. The attempt is being made to define the characteristics of an equivalent box for man as a social being. But social problems do not derive solely from an individual's dissatisfaction with his 'social box' as determined by the inputs to the box-they also derive from the outputs and the dynamic relationship of the box to other boxes.

The categories into which human beings are divided are less significant than those which describe the way people act together in subsystems, groups, and organizations. 'It is the intricate network of the subsystems that, more than anything else, establishes the framework of social structure.' (8)

In discussing the type of information collected by the United Nations for its Report on the World Social Situation, Gross notes that it is restricted to standard-of-living concepts developed a decade earlier.

Thus, neither art nor recreation neither political nor business institutions are included as part of the 'social situation' in any country in the entire world. 'Social' is used to refer to certain minimum welfare concepts . . . rather than to major aspects of society? (9)

Details are available on the number of cinemas, newspapers, radios, libraries, and so on, per capita in each country. No systematic collection of information is available on the number of local, regional, or national groups and interlacing social structures in different areas, even in the developed countries. The first set of information could be considered as representing methods of informing, instructing, or influencing individuals - namely, the downward flow from centers of power and excellence. The second, and missing, set corresponds to methods by which individuals and their minority groups can express, protect, and further their particular interests. This is the upward flow of information, filtered and colored by interaction between all elements of the social structure. These are the channels through which individuals participate in society, refine definitions of values, and mold the direction of development. Any approach to social development, which ignores social structure, cannot indicate whether the individuals' non-welfare needs are met. Nor can such an approach highlight those features of the social structure, which obstruct effective social or economic development proposed at particular points in the structure.

It would be an interesting exercise to analyze the effectiveness of suggested social indicators as a means of detecting the minimum social conditions represented by both the UN's Universal Declaration of Human Rights and Maslow's hierarchy of human needs.' (10)

Lack of information on the network of interlinking organizations has the following direct consequences:

- there is no unambiguous procedure by which the best placed organizations or centers of competence can be located with respect to a particular program;
- all the potentially interested bodies cannot be located at the appropriate phases of the conception and implementation of a program;

- emphasis is placed on particular organizations (encouraging duplication of programs and competition for limited resources), rather than on the network of organizations whose resources and complementary abilities could be combined;
- organizations become effectively isolated in particular sectors of organization space. This isolation permits an organization to create a viable 'market' for its 'products' in competition with more distant bodies. But the lack of a clear overview prevents the proposal, justification, or development of any analytical techniques, which could establish at what stage such fragmentation becomes dysfunctional, and to what sectors of society. Contact is with other organizations being governed by traditional procedure, rather than a systematic determination of the most appropriate contacts for a given program;
- the traditional boundaries between program areas are reinforced to the detriment of programs requiring a multidisciplinary approach.

Social integration, which may be assumed to be a desirable if not a necessary parallel to economic integration, cannot currently be measured systematically in unambiguous terms. A very precise concept of social integration is the degree of interlinking of individuals in groups or groups within larger organizational structures. Each additional formal link represents an increment in the degree of integration in the particular area of organizational space under review. Measures of the number of person-to-person, person-to-organization, or organization-to-organization links therefore provide a clear picture of the degree of complexity or even sophistication of a segment of society. It could be argued that this type of knowledge is an essential preliminary to the design of adequate economic development programs. The manner in which link patterns change over time as programs sponsored by different bodies are implemented, provides an important indication as to whether the society is adapting to economic 'development' or merely introducing mechanisms to compensate for it and 'contain' its effects. It is only with this sort of knowledge that it can be unambiguously demonstrated which economic development programs are destroying valuable social structures-without replacing them - or assisting in the creation of less desirable social structures.

A major current weakness of research on social structures is that it concentrates on single organizations with similar characteristics, only rarely on links between organizations with the same characteristics, and only very rarely in an open-ended manner on all detectable links between bodies. (11)

Given the desirability of organizational information as argued above, how is such information to be collected, made available, and updated? The key lies in the use of computer and communication systems, but there are two sets of problems. First, such systems are generally recommended and funded for business and administrative purposes, or for programs, which do not directly contribute to social development. Secondly, the manner in which they are organized is not to the advantage of all concerned - or if it is, is probably not viable.

As an indication of the first case, in an otherwise excellent report on the application of computer technology for economic and social development, the United Nations Secretary-General states,

In general, however, determining where computers can be used to maximum effect in developing countries is a matter of great difficulty and great importance. It depends in part on which sector of the economy it is desirable to emphasize . . . (12)

The most challenging way in which a computer can contribute to economic development is . . . (13)

There is no equivalent discussion of social development. 'Economic and social' in the opening pages is modified to 'economic' further on, which is finally identified with 'development' at the close. One is left to conclude that, with the exception of the *indirect* uses of computers to plan, model, administer, analyze, or document *conventional* social development programs, computers cannot contribute directly in any dramatic manner to social development. Social development is not a direct, natural consequence of improved social research or program-administration efficiency, although this is easily assumed. These are both detached from the conditions and environment it may seem desirable to improve.

In marked contrast to the remainder of the report, there is one section on the undesirable consequences for society of the suggested computer applications, namely, the issues of privacy and non-participative decision-making. Reference is also made to a resolution inviting the Secretary-General to undertake a study of their effects on human rights.

The need for this negatively reassuring section could be considered a direct consequence of the inability to identify any positive social development applications to counterbalance the emphasis on economic development and administrative efficiency. Experience in the United States would seem to indicate that success in the field of economic development is a direct cause of social problems. Is it impossible to use a computer system so that the negative consequences of one application are counterbalanced by the positive social consequences of another? If computer systems can be used directly in a highly dynamic manner to identify new economic opportunities on a day-by-day basis and to facilitate the resultant corporation-to-corporation transaction, (14) is it not possible to develop equivalent applications to facilitate identification of socially significant contacts - as a means of dramatically increasing the rate of social development, the degree of social integration, and the degree of individual involvement in society? (15)

Viable Collection Systems

Given the desirability of organizational information, as argued above, how is such information to be collected, made available, and updated? The information systems on organizations, which are currently planned, or in operation at the international level possess one or both of the following objectives:

- (a) They are system-centered namely, they organize collection or use of information in such a way as to maximize the benefits to the group *controlling* the information system, and are only incidentally, if at all, concerned with the effects of such a system on

the individuals or groups documented.

(b) They are group-centered namely, they organize collection or use of information in such a way as to maximize the benefits to the groups whose own data are in some way merged or *exchanged* within the information system to increase combined program effectiveness.

Such systems are faced with the following major problems, in varying degrees—depending upon the mix of their objectives:

- location and collection of data (namely, the problems of producing reasons to justify the expenditure of time and effort by the groups supplying the information);
- updating the information (namely, the problem of guaranteeing a continuing supply of information from the same sources, in the presence of similar time-consuming demands from other sources);
- financing the collection of information and operation of the system.
- protection of the confidential information supplied (namely, the problem of making available selected parts of the data to categories of users in a manner defined, ideally, by the group supplying the information);
- protection of the 'data assets' and, to some extent, the identity of different collecting groups which integrate their information systems to increase combined effectiveness.

System-centered information systems are typically easy to justify to fund sources, and in many cases may be tied into short-term programs (whether the 'one-off' research program of a university or of some international program-oriented group such as UNESCO). They suffer from the disadvantage that the arguments used to justify collection of the information may have considerably less significance in the working environment of the group supplying the information. This reduces willingness to supply the information, particularly on a continuing basis, and increases suspicion as to the ends to which it is to be put in the particular country where it is being collected.

Group-centered systems can be justified to the groups in question which are prepared to supply the data, but are typically difficult to justify to potential sources of funds, even the groups themselves, since specialized program mandates cannot be broadened to justify allocation of funds to the construction or operation of generalized information systems. Such systems are susceptible to inter-group disputes.

The principal problems of these two types of systems could, however, balance one another out, if a hybrid multipurpose system were developed—to be of use both to the groups incorporated in it and to others wishing to contact, influence, or study those groups. A system of this type would not only solve the practical problem of information collection but would in itself represent a significant step toward functional integration. A direct consequence of the creation of unrelated systems to handle research, planning, public information, education, and program administration needs, is that insights or problems arising in one area are not evident to groups concerned with other areas. Any new research insight concerning the world system should rapidly affect policy-making, education, public information, and the like. Developments in each functional area must increasingly mesh smoothly together and reinforce one another instead of proceeding in leaps and starts. Information systems constitute the nervous system of planetary society. The fragmented approach to their design and use would seem to lead directly to social crises analogous to those found in the case of certain disorders of the nervous system, as though the world system were some organizational dinosaur suffering from spastic paralysis or aphasia. Integrated development can be achieved only if the information system is designed for multipurpose use. (16)

Realism suggests that no significant change will be made in the existing approach. It is also extremely doubtful whether a centralized information clearing house is desirable or practical in political or economic terms. It is, however, possible to envisage an information system, which avoids the problems noted above. This is described in the next two sections.

Criteria for an Adequate World Information System

The system is based on the assumption that in order to formulate a global or comprehensive strategy requiring or affecting a variety of organizations, it is necessary to maintain an updated picture of who is doing what, where, and when—for the present and the future. Since neither problems nor the future are respecters of jurisdictional boundaries or imposed categories, the system must overcome resistance to communication and loss of coverage caused by the following: established administrative, jurisdictional, political boundaries, geographical separation, conceptual separation arising from divergent specialized disciplines, different evaluations of effectiveness—often arising from past limitations on information received class and status separation, and differences in available resources to collect and process information—the latter being a condition which leads to different impressions of the necessity for a greater degree of 'transparency' in the world system.

Inasmuch as a great deal of funds and intellectual and emotional capital are invested in the current organizational and category structure, the system must avoid the necessity for organizational change or the threat to traditional bonds.

This also applies to existing or planned information systems, such as that advocated in the UN Capacity Study—which is constrained by the years of effort put into the UN, ILO, FAO, and UNESCO library systems. The system must therefore act as a linking process into which information may be fed from specialized systems with their own security constraints, and from which information may be drawn according to specialized filtering profiles.

Since a major problem today is to get public support for, and involvement in, projects falling outside an organization's normal sphere of interest, the system must be directly useful to the organization within its own sphere of interest, although providing it with the facility to increase its awareness of more distant or inclusive contexts—to the limits of the world system.

Deriving from this is the need to ensure a minimum operational and set-up cost for the system, so that the system may be self-

maintaining, generating resources, which are used at a point at which they can be seen to be useful by the fund suppliers.

To ensure maximum realization of its potential, it must be possible for the system to juxtapose information concerning groups with related interests in such a way that each group is made aware of the potential value of contacting the other. The decision to communicate directly would rest, of course, entirely with each group. The function of the system is to bypass the encrustation of social mechanisms, which render society and the world system opaque, thus blurring the perception of useful contacts.

Because world problems are of such a nature and complexity, and growing at such a rate, as to make it impossible to depend upon the 'resolving power' of one group or cluster of groups to detect the problems at a point in time before they are close to becoming critical, the system could be conceived of, described, and used as a problem-detection mechanism, to the end that in their very diversity and distribution through function and geographical space, all groups are seen to have the potential to report on the areas of their concern. The information system functions as a problem-detection mechanism because each group is best able to detect problems highlighted by its own category structures in that part of the social process where it is embedded. The system 'amplifies' the registration of problems by all such 'look-out' groups, so that such knowledge penetrates further into distant sectors of organization space, alerting other groups less sensitive to the problem symptoms.

Problem information, or negative feedback, therefore enters the communication system much earlier in time than would be possible if, as now, it were necessary to depend upon particular organizations or programs set up in the past to detect the problems considered significant in the past; for these cannot, by definition, be sufficiently flexible to detect new problems before they have achieved considerable magnitude.

Finally, such a system should not be described solely as a device or tool. It could also be conceived of and described as a symbol, or physical working model, of what has always tended to be an abstract and relatively meaningless concept, namely 'world society' or the 'world community.'

The elaboration of such a network, linking all organizations within the world system in terms of their actual, day-to-day pattern of contacts, would decrease the current tendency to treat organizations as relatively isolated entities. The existence of such a model, open for 'exploration,' could have social, psychological, and educational consequences of considerable value to the stability of the world system.

Specification of a Possible Information System

The following system is one of many which could fulfil the above criteria.

Suppose that every organization (and even active individuals) were given the facility to register its address, interests, current and planned programs, and the like, into a computer file. The act of registration could be accomplished through the mail by filling out a standard form. Clearly, this project would prove impractical if the attempt were made to do this at an international central office. The amount of information would be too great, making the processing too costly.

Suppose, however, that the project were catalyzed (not organized) by the United Nations and other such bodies, and the attempt made to encourage the creation of city, province, or national-level computer files around the world. In some cases only a national or even sub-continental file would be possible; in some cities, local files would be possible. This would reflect the amount of information and the resources available.

Now suppose that in addition to indicating regularly any changes of address or interests, each group were to file queries concerning other groups actually or potentially active in its field, and that the appropriate addresses were furnished in response. By catalyzing the creation of collecting points in this way, grassroots initiative would ensure that the coverage for collection/query response would be adequate for a viable service.

But now suppose the computer files of the different collecting points were not kept isolated from one another, but that copies of the files were moved from one collecting point to another, either physically or via a data link. Contacts and queries collected at one point are now exposed to contacts and queries from other points. This process could take place between local points (within the same province), sub-national points, national points (within the same continent), or international points.

The circulation of information could be made very rapid. A courier file could be circulated between local points in the same province or city during the course of a week, month, or longer. Information would be copied onto and off each local file. At one point the file would interact with an inter-province courier file moving from province to province within a week, month, or longer. Information would be transferred both ways. Similarly, the inter-province file-in effect, a national file-could interact with an international courier file on the same principle.

By this means, organizations active in one geographical area could find out about, or be made aware of, groups with related interests in other geographical areas. A refinement would be to encourage the creation of specialized files by subject or subject groups. If collecting points were created for specialized topics, these might also interact with either inter-specialty courier files or the inter-geographical area files—depending on the level at which the information was collected.

The system would be very flexible. A politically sensitive group of organizations like the UN agencies could circulate a file around the UN system and then have it interact with the international courier file. Security, subject matter, and evaluative filters could govern the interaction.

The key feature of the system, however, is that it does not require more than a bare minimum of over-all organization—and even this could prove unnecessary. The system could be extended very loosely on local initiative where the demand and resources exist. Neither the courier file movement between collecting points nor the content of the file implies any form of 'recognition.' Collecting points could

be created wherever-in terms of subject, jurisdiction, or geographical level-there was sufficient common interest, that is, motivation in addition to local resources.

Each courier file 'belongs' and is of maximum use to the points serviced. This gets around the current situation, in which the vain attempt is made to get significant funding channelled via international levels.

If cross-jurisdictional problems arose in particular areas, all the administrative work there could be relegated under contract to a third party judged to be impartial and uninvolved - a commercial computer service bureau, a university, a government agency, or a 'cooperative point' might be organized for users.

Hopefully, the selection criteria, if any, of each collecting point could be clearly stated to facilitate the design of search strategies. But if information or queries were not accepted at one point, they could be inserted into the system via another.

Costs of the System

The costs involved at each collecting point would cover:

- (a) conversion of information and queries to machine-readable form,
- (b) processing and output relevant to immediate user contacts, and
- (c) transport costs of the courier file to the next collecting point.

The funds would be expended locally in a manner, which could be immediately justified, and yet would result in making available locally the current information from very distant points within the world system.

These costs could be met by

- (a) a charge imposed on the user groups for filing a description of their function and interests, plus address,
- (b) a charge imposed on groups filing queries and/or receiving output replies,
- (c) a charge imposed on groups using the system for bulk mailing, and
- (d) subsidies from directly interested groups such as local, state or national government agencies, foundations, and so on.

The charges could also be met or reduced by the use of subsidies. These could be made selective and dependent upon compatibility of the interest profile of the subsidizer and the user-query profiles. Note that the financing of the system does not need to be comprehensively organized.

The system would lend itself to some very interesting financing possibilities in the case of bulk mailing. The risk here is that registration on the file would lead to floods of literature to particular addresses or profiles. This nuisance could be minimized with a flexible charge procedure. The addressed body could specify the type of information it wished to receive. It might be given the option of specifying the 'barrier' it wished to impose against information outside this range. The 'height' of this barrier could be governed by the amount of the original filing charge paid to the collecting point.

Similarly, the querying/ mailing body could specify what 'height' of barrier it wished to overcome and pay accordingly for this privilege. The extra revenue derived from this could then be treated as 'free processing units' and transferred to the 'accounts' of the groups, which have been 'bothered' by this nuisance information; this increases their ability to make use of the system.

A problem would arise at the interface between different level courier files as to how much information should be transferred up or down. For some applications, it would clearly be an advantage to have the accumulation of all material from all levels, in all parts of the world system. This could, however, be arranged very flexibly. The processing cost would, of course, be limited if only modifications and queries were moved around by the courier files.

A system of this type could be studied in advance with the use of simulation techniques, in order to eliminate design errors.

Advantages of the Proposed System

The most important advantages of the proposed system are implicit in the criteria. But basically the system attacks directly the following problem:

Many IGO's, particularly the specialized agencies of the UN family, have extensive relationships with some INGO's but participants in all kinds of international organizations express inability to keep informed on relevant activities of other organizations (17)

This problem is not confined to the international level but extends down to contacts between all types of organization at the national and sub-national levels.

No existing bodies have information processing commitments, which could not mesh with this type of system. In the next few years a multitude of "uni-problem," specialized information systems will be created.(18) Some form of more general, decentralized, rapid

response system is required to supply a context for and link-mechanism between such systems.

Similar 'profile' systems operate through single processing centers for 'awareness listings' of new published material. Such systems are costly to maintain and costly to use. They cannot cover more than a limited range of subjects. Because of the focus on published material and documents, they are frequently six months to a year or more out of date. For each individual organization the main advantage is that it needs to be concerned only with getting its program information into the central file and extracting whatever information is available on other groups active in the field. It does not have to consider whether it recognizes the organization interested in that information.

This technique provides a rapid shortcut for groups and agencies in developing countries wishing to benefit from a comprehensive database. Some specific advantages are:

- it is a systematic, rapid method by which developing countries can signal existence of programs, problems, or interests which could benefit from regional contact (that is, facilitating regional integration) or international contact—for instance, a fisheries or water conservation program, or a water-borne disease, which could affect neighboring countries;
- similarly, such countries can detect or be informed of groups in other countries from which assistance might be requested, or with which some form of collaboration might be developed—for example, local health or family planning programs which might call on appropriate international bodies;
- attention is focused internationally on the problems a given developing country has in responding with its limited resources to the plethora of complex opportunities made apparent by the system. This should lead to techniques of intelligent, as opposed to haphazard, simplification, to the country's benefit;
- in the possible absence of funds for appropriate computer equipment, the processing required could be done in a neighboring country or at some regional center, and the results distributed within the country with the same effectiveness as if it did have such equipment. This also applies to different geographical regions or cities within a country. By this means, the benefits of computer processing will penetrate much more rapidly throughout the developing countries than if the stress were placed on computer ownership with its associated costs, problems, and sub-optimization.

A major advantage is that such a system would get behind the superficial categories distinguishing governmental, private, business, and voluntary organizations. This is important because, whereas the distinctions may be significant at some levels of their respective hierarchies, the subsections concerned with substantive matters may benefit greatly from exchanges of information. For example, subsections of all the above types of organizations might be concerned with the distribution and use of educational material in a given region.

This type of approach could avoid some interdepartmental jurisdictional problems in large organizations such as governmental and intergovernmental agencies. Since the department filing the information, or registering interest in a particular category of information which may at some stage appear on the file, is not in contact with any particular outside organization for any purpose, there would be no grounds for friction with other departments. Once the information was obtained, normal channels could be used to contact the outside body. The technique would be, in effect, ideal for circulation of internal information across jurisdictional boundaries. Each department would be sent, via the computer, any information filed by a department in another part of the organization, if it fulfilled the profile criteria. The only resulting link would be the common interest in a subject registered via the computer. By ensuring that the computer automatically redirected or addressed information on a particular subject to the persons who had registered an interest in that subject within the agency, the effectiveness of retransmission would be considerably increased. The fact that profiles could be updated very rapidly would make this type of system an ideal means for an organization to respond rapidly to cross-jurisdictional problems.

This approach avoids the communication blockages, which arise because a particular organization is assumed to have programs in a given area only. Some subsections of an organization may in fact have programs, which touch on an entirely different sector—for instance, FAO programs touching on health (WHO) or education (UNESCO). Rigid classification of FAO would prevent groups interested in health from becoming associated with FAO programs in this area. This is particularly important in the case of interdisciplinary environmental problems, or broad areas of interest such as development, which may cover any specialized programs.

Processing of files may be undertaken using very different types of equipment. If a file is transferred to disk or drum, direct-access processing can be used. This would permit consultation via remote terminals in offices scattered through an agency—a technique, which will soon be widespread in the computer-sophisticated countries. A great variety of research can be envisaged.

Perhaps the most important advantage is that effective links are encouraged vertically between different levels of the world system, leading to geographical and subject-area coordination, reinforced by horizontal links between 'opposite numbers' in other countries or disciplines. Due to the increased sensitivity of each organization to other activities in related fields of interest whether obtained by active querying, or by being informed through the system—the coordination problem will be reduced because of increased "self-coordination".

It will be less necessary to impose coordination.

By getting down to the grass roots of the world system, an information system of this type produces a genuine response the type of complaint cited by the Capacity Study:

For development assistance to have a real impact, it must start at the roots; development from the top down, although it may appear as the most expedient way to how progress in the short run, is not only receiving but uneconomic as well as unrealistic.

(19)

Ensuring Recognition of Relevant Information

Enthusiasm for computer-based information systems such as that described above must be tempered by a very important factor, namely,

that there is already too much information to read and digest, and the rate of increase is a problem in its own right. It is now practically impossible to determine what information outside one's own discipline is relevant to a problem, or to obtain the documents in question within time and resource limits, or to read them, or to understand them, if one is from another discipline. Having understood them, the same problems arise in attempting to ensure that one's understanding is communicated to other busy people (with differing abilities to comprehend the information) in order to obtain support for a course of action and for a politician, this may include the general public. These problems are getting worse, and are of particular importance to developing countries which do not possess an extensive array of specialists.

Many developing countries . . . had not solved the formidable problem posed by the sheer size of the information-distribution functions, and the related need for timely consultation, which arose in connection with the multifarious points of contact between their countries and the international system . . . (20)

The copious documentation provided . . . loses much of its value if it cannot be mastered by the government representatives for whom it was intended. (21)

The system described in the previous sections is an economically feasible method of systematically picking out contacts relevant to a clearly identified problem. This is, however, only adequate as a stop-gap operation, for how does one organize information when one considers the following?

The most probable assumption is that every single one of the old demarcations, disciplines, and faculties is going to become obsolete and a barrier to learning as well as to understanding. The fact that we are shifting from a Cartesian view of the universe, in which the accent has been on parts and elements, to a configuration view, with the emphasis on wholes and patterns, challenges every single dividing line between areas of study and knowledge. (22)

How are those concerned with strategies for social development to select an appropriate course of action when the situations are these?

- each problem is, in fact, a network of problems nested within a network of problems;
- a rapidly evolving network of organizations of all kinds is concerned with each set of problems in a variety of ways;
- the decision-maker's background prevents him, even if he is aware of it, from being able to distinguish between that which is irrelevant and that for which he would require a more or less extended briefing to establish the relevance (or irrelevance);
- the nature of, and reason for, the complex course of action selected must be relatively easily communicable to others, particularly the mass media, in the interests of a democratic review of decision making;
- the time taken to print and circulate much information sent or received nearly exceeds its period of relevance to decision-making;
- each course of action selected has both positive and negative consequences for other problems and groups;
- decisions taken by different groups on the same problem at the same time, but in ignorance of one another's plans, may result in programs, which interact disastrously.

These questions of comprehensibility, relevance, and the communication of concepts impose new regulations on the adequacy of information systems. These will become increasingly significant as social problems become more complex over the next decades. It is therefore time to look at the type of system we require to be able to respond adequately under such conditions. Such systems require intensive research, particularly in safeguarding the rights of the individual, in order to ensure their adequacy and availability when essential.

Facilitation of Program Interaction

Once a 'best' supply of data has been guaranteed by a system of the above type, the more fundamental problem arises of how this 'best' is to be made available. The degree of interconnectedness of organizations, programs, and disciplines, is of increasingly greater significance. Interconnectedness is very difficult to display in 'one-off' sections through a data bank.

The point has been made that projects and programs formulated and controlled by groups which do not communicate effectively with one another (perhaps because they do not 'recognize' one another's existence), may nevertheless interact in an undesirable manner. A simple example of this is the case of a crop improvement project (e.g., FAO/ Agriculture), which makes intensive use of fertilizers. The chemicals may be partially washed away through the soil into the local river and cause the death of fish in a fisheries project (e.g., FAO/ Fisheries) further downstream.

A common example in developed countries is the case of roadway repairs. A main roadway is first repaired by the roadway construction authority, then dug up again, first by the gas distribution authority, days later by the electricity supply authority, a week later by the water supply authority, and so on. Although not dangerous, this results in needless waste of resources and disturbance to traffic, which can be very important to productivity. The visible lack of coordination in digging up and repairing the road surface is, however, symptomatic of methods and underlying attitudes which may be very difficult to detect in other contexts and yet give rise to extremely dangerous or costly project interaction.

'We have no idea how large a proportion of our present production serves only to compensate for the disutilities and diseconomies created by other parts of our production.' (23)

A very similar coordination problem is also faced by engineers designing multi-story, complex chemical or other factories. Each

specialized group of engineers is concerned with a different system: chemical, electrical, ventilation, cooling effluent, fire security. The results of the interacting activities of designers working simultaneously must be harmonized into a coherent architectural plan.

The primary problem when designing a large complex system is to control the utilization of three-dimensional space during the layout process. In a large system the work of numerous specialists must be closely coordinated in order to ensure that no two objects are placed in the same space, and that the interaction of layout and systems characteristics does not necessarily degrade the performance of systems. Ideally, everyone would work on one large drawing. . . . However, one large drawing - actually - is obviously impractical. (24)

In the design of a strategy against world problems, or any type of problem crossing jurisdictional or discipline lines, the 'three-dimensional space' becomes a multidimensional function space with time as a dimension. The 'objects' are project activities. (This is quite close to the concept of project control using PERT techniques.) The major difficulty is that coordination cannot be imposed over wide domains. It is essential to depend on the more democratic process of self-coordination on the part of groups and organizations responsible for potentially interacting projects. This must depend on their comprehension of the critical areas of potentially wasteful or dangerous interaction and their dynamic counter-balancing response to each other's activities.

Groups cannot be persuaded to consider the effects of their activities on other parts of the system unless the effects are made clear to them. This brings up the whole question of what constitutes the adequate presentation and explanation of a problem. The presentation of information must be such as to maximize insight and learning within short periods of time. It must also offer some means of retaining all the precision necessary to permit detailed examination of the system. For this reason, it is interesting to note the solution now advocated and, in some cases, already implemented for the engineering problem mentioned above. The same author continues:

Using interactive computer graphics, however, it is possible for everyone to work on a 'single drawing'; through linkage of the graphics with analytical programs, the correlation between layout of a system and the system performance characteristics is automatic. (25)

Each team of engineers makes use of a terminal linked to a remote computer. The interactive graphics terminal is a means of displaying complex drawings or three-dimensional structures on a cathode ray (television-type) tube. Such drawings appear as thin lines of light and may be altered by each team with the use of a 'light-pen.' Structures like electronic circuits, pipeline networks, or three-dimensional architectural or engineering structures are currently treated in this way. Each team can therefore interact with the computer, modify its part of the structure, and ensure that the modification will not adversely affect the systems, which are the responsibility of other teams. The results of each change on the system as a whole may be analyzed with the aid of the computer.

There is no reason why the interaction between the projects of different organizations or departments should not be handled in a similar manner. It is possibly the only adequate way of presenting the essentials of an inter-organizational situation simply, rapidly, comprehensively, and with the facility that specific and amplifying details and analyses may be obtained from the computer at the push of a button on the terminal. This is the key to effective decision-making and public understanding of the implications of organization decisions. (Videotapes of the proposed changes could form highly informative newsreels). It is also an ideal channel through which interested citizens can explore, learn about, or be briefed on the complex organizational environment which surrounds them and the key points at which they can effectively participate in the light of their own individual interests.

By the second half of the Second Development Decade, interactive graphics could prove to be the key to the problems of the following type:

... The problem created by different and conflicting decisions taken by intergovernmental organs with . . . the same membership . . . has so far proved relatively intractable to treatment by exhortation. . . . It is potentially such an important source of dissipation of international resources in the fight for development that the Enlarged Committee felt it could not be ignored. (26)

In order to treat very large structural entities graphically (for example, a complex organizational network), the display surface can be set up to represent a window on, or projection of, one aspect of one part of the structure. For a particular application, it may be necessary to work with a number of such detailed sections by 'moving' the display window to view different portions of the structure as a whole. A capability can also be provided to 'zoom in' on a small portion of the structure, if it is three-dimensional, in order to get a better picture of the relationship or lack of relationship between the parts.' (27)

The fundamental importance of interactive graphics is the ability to facilitate understanding. Progress in understanding is made through the development of mental models or notations that permit a simple representation of a mass of complexities not previously understood. The greater the complexity, however, the more difficult it is to use mental models, and hence the greater the risk of dangerous conceptual short-cuts and oversimplifications. For example, in a description of his own mental models of the operation of electrical circuits, one author writes:

Unfortunately, my abstract model tends to fade out when I get a circuit that is a little bit too complex. I can't remember what is happening in one place long enough to see what is going to happen somewhere else. My model evaporates. If I could somehow represent that abstract model in the computer to see a circuit in animation, my abstraction wouldn't evaporate. I could take the vague notion that 'fades out at the edges' and solidify it. I could analyze bigger circuits. *In all fields there are such abstractions. We haven't yet made any use of the computer's ability to 'firm up' these abstractions.* The scientist of today is limited by his pencil and paper and mind. He can draw abstractions, or he can think about them. If he draws them, they will be static, and if he

just thinks about them, they won't have very good mathematical properties and will fade out. With a computer, we could give him a great deal more. We could give him drawings that move, drawings in three or four dimensions, which he can rotate, and drawings with great mathematical accuracy. We could let him represent all kinds of very complex and very abstract notions, and we could let him work with them in a way that he has never been able to do before. I think that the really big gains in the substantive scientific areas are going to come when somebody invents new abstractions which can only be represented in computer graphical form. (28)

It is this sort of facility which the political, social, information, and management scientists and educationists require to increase the adequacy of their individual and combined approaches to the world system and its subsystems. It appears probable that only abstractions of the above order will prove an adequate means to conceptually contain and represent to differently sophisticated audiences the complexity of social processes -particularly for planning and decision-making purposes.

The critical areas highlighted by any one discipline or group must be drawn to the attention of others. No single group or combination of groups can, by definition, possess a sufficiently general perspective. A new medium, along the lines of that described above, and backed by a viable collection system, is required to facilitate interaction across disciplinary boundaries and to act as a medium in which a variety of perspectives may be anchored, juxtapositioned, and examined in terms of both academic and decision-oriented criteria.

The two information systems described here are complementary and respond to the problems identified. The first focuses on the currently critical problem of obtaining and maintaining a clear picture of the entities affecting changes in the social process, while using the information to the benefit of all concerned. The second focuses on the currently less critical problem of manipulating this information in new ways to make it more readily and rapidly comprehensible and communicable across traditional social barriers. Information systems can be either 'about' social development, contributing to an understanding of it, or they can combine this research function with the complementary information needs for policymaking, education, public information, and program management, while catalyzing directly the social development process itself. The potential role in this respect of user-oriented (as opposed to mass media) information systems has received little attention.

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 3. Capacity Study, vol. 1, p. 4.
 4. Each group of persons committed to one area of knowledge or activity is, from this area, apparently surrounded, within such a space, by the more or less chaotic collection of activities of other groups of barely understood significance. This resembles somewhat the science-fiction prediction of the migration of man to distant planets and galaxies, with the resultant fragmentation of mankind into subcultures with little intercommunication. In man's colonization of, and commitment to, the different domains of the universe of knowledge and specialist activity, the equivalent of this situation may already be considered to exist. Each group considers its own perspective to be of most relevance to the solution of any problem -or else considers the problem to be of relative insignificance, or the responsibility of some unspecified body.
 5. Capacity Study, vol. 2, p. 422.
 6. B. M. Gross. Organizations and Their Managing. Free Press, 1968, p. 636.
 7. As an example, in justifying the exclusion of certain categories of organizations from an adequate data base on the global system, Michael Wallace and J. David Singer make the following point: 'First, our theoretical interests (and, we suspect, those of most of our colleagues) are more concerned with IGO's [intergovernmental organizations] than with nongovernmental organizations (NGO's) One can hardly urge that the amount of NGO is likely to be important in accounting for many of the theoretically interesting phenomena which occurred in the system of the past century or so.' 'Intergovernmental Organizations in the Global System, 1815-1960; A Quantitative Description,' *International Organization*, 24, 2 (Spring 1970), p. 240. For some of the consequences of this, see Chadwick F. Alger, Research on Research: A Decade of Quantitative and Field Research on International Organizations. (Paper presented to the American Political Science Association annual meeting, September 1969.)
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