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SCIENTIFIC INFORMATION AND THE NEWLY
DEVELOPING COUNTRIES

by

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Scientific information constitutes one of the basic structural elements of any scientific organization. But the topic has not been given sufficient attention in discussions of the crucial problem of implanting science in so-called underdeveloped or newly developing countries. Evidence of this can be found from examining the list of papers of the recent conference on the application of science and technology for the benefit of the developed areas ¹ held in Geneva under the auspices of the U.N. where among thousands of topics considered only ten dealt with, or analysing the research projects on scientific information, carried out in different countries as listed by the National Science Foundation ².

If we agree that the promotion of scientific and technological activities is a prime factor in the development of backward areas, and if we acknowledge along with many specialized agencies ^{3, 4, 5, 6} that without an operational system of good inter-communication there can be no research and consequently developmental science, then our deficiencies in these areas takes on an especially serious character. We agree that science and technology are primary factors in the development of a country rather than the consequence just as we acknowledge the results of the conferences held at Rehovoth in 1960 ⁷ and at Geneva in 1963 ⁸. There is a need to stimulate research in less advanced parts of the world, because to these areas an accelerating scientific development is even more essential than in the developed areas. If this is not accomplished, the distance between the widely separated areas will increase. According to available data based on percentages of the gross national product (GNP) invested in science, we can estimate to a 50 to 70-year timelag in India's scientific development behind that of the United States. The tendency is for this differential to increase rather than diminish, since the slope of India's scientific growth curve diverges substantially from that of the U. S. Still, in India we are dealing with a developing country that has greatly emphasized science and possesses a Ministry for Scientific Research and Cultural Affairs. If we consider other countries where the

percentage invested in these activities is unknown, prospects for the future are still less encouraging⁹.

We should admit, therefore, that investment in research must be greater for the underdeveloped countries than for those with a high socio-economic potential, because only through investments on a much larger scale can the newly developing areas hope to overcome their present precarious condition. If this be a valid economic proposition then we must also re-examine the premises that led to the establishment of 2% of the GNP as a desirable minimum for achieving scientific and technological progress, capable of insuring satisfactory socio-economic conditions to developing countries. But quite apart from such considerations, we know that adequate information is essential to scientific work and a vital ingredient of the complex structure of research. Therefore, along with other equally basic measures, it too must be planned.

This proposition gives rise to several fundamental questions:

- a) What is being done in developed countries concerning scientific information as it applies directly and immediately to developing countries ?
- b) Can the developing countries establish direct connections and integrate themselves with information facilities of more advanced societies ?
- c) Should the developing countries create their own system of scientific information through local experience and research ?
- d) Or, would an intermediary position be more suitable, whereby developed communications systems are expanded and adapted to conditions peculiar to underdeveloped areas ?

Obviously our replies to these questions must be more conjectures, since we lack concrete data from research or carefully collected experience on which to base a qualified opinion.

Besides, whatever merit the ideas may have that follow, we should not generalize by considering them valid for all countries of the developing world. Underdeveloped areas are complex and highly heterogenous, with each country or region presenting cultural peculiarities of its own. In any case this discussion will be based on observations gathered in Brazil and to a lesser extent on information about other Latin American countries.

Regarding the first question, on whether a transfer of scientific information systems can be effected directly and immediately from advanced to less developed countries, the answer must be equivocal. Were it possible to pass on this experience, the results would be economically very advantageous, since the poorer areas could be spared the pain of financing research to establish new systems suitable to their needs. Unfortunately such systems can be transmitted only partially since they have been developed in countries with high socio-economic levels and cultural characteristics different from those prevalent in developing countries.

The second question concerns the possibility of integrating the scientific communities of the newly developing areas with those of the already developed, by using the latter's systems of communication. This would be a highly desirable solution, since it would cost less in time and money. Also it would contribute to the realization of an ideal aspired to by many, to lead all peoples of the world toward what Ritchie Calder¹⁰ calls "global civilization", i.e. "a planned, rapid, and simultaneous change of most complexes of existing cultures in the general direction of the developing world culture".

In this respect we should take note of the fact that the best scientists of scientifically still developing countries do participate in the already extant international scientific network. But at the cost of working decidedly apart from and outside of the cultural and scientific structure of their own societies. They receive information through formal or informal channels of communication that are structurally not

in tune with their environment and, in return, transmit the results of their work abroad. In this way their findings neither circulate at home, where they are usually unknown, nor benefit their compatriot colleagues. This situation is obviously undesirable, since the scientific productivity of the underdeveloped area is siphoned off, without directly enriching its areas of origin. This may be considered harmful to the interests of the countries by constituting an unproductive investment. The fact, in any event, exists and neither can nor should be repressed because it would inhibit talents which find no local market for their output. Nevertheless, it should be remembered that when a scientist becomes part of a foreign system, his whole approach to research is naturally directed toward interests prevailing in that system. The extreme consequence of this chain of events is the eventual migration to other countries of scientists isolated at home and cut off from adequate working conditions. In Brazil this has been especially serious in the field of physics, where the nation's best men left to settle in more promising environments. This demonstrates the pronounced drawbacks for underdeveloped areas to remain passively hitched to advanced bandwagons, and points to the need for a more serious and coordinated study of the whole problem.

These comments refer primarily to individual cases or small groups of scientists. Within a broader frame of reference, what stands against wholesale interchange and an effective integration of entire cultural and scientific complexes are, among others:

- a) The quantitative and qualitative cultural, economic, and financial differences;
- b) The manifold linguistic and conceptual differences;
- c) The lack of access to formal or informal information;
- d) The general lack of continuity due to cultural immaturity and political instability;
- e) The complexity of advanced information systems, more

varied and perfected by mechanical processes, automation and computation, unavailable to the less advanced areas;

- f) And above all, the different motivations among people living in ecologically distinct areas.

I would have to go into great detail to discuss each of these aspects, so I will limit my remarks to the main aspect of the question. Qualitative and quantitative differences from the cultural viewpoint obviously constitute an obstacle for an underdeveloped country to use the information produced in a developed country.

Scientific development involves stage and age of development, or degree of maturity and it is obvious that communica-

tion among heterogenous systems, can not be suitable carried out. Language does not present a difficult problem from the viewpoint of comprehension. However, in identifying thoughts or transmitting concepts, language assumes more complex characteristics. Economic differences are serious obstacles to interchange, because the costs of producing information in developed countries are adjusted to their financial standards. There are, however, projects in these countries¹¹ for the purpose of determining whether the cost of the information is accessible to all those who need it. But these costs are more than the underdeveloped countries can afford. This situation, which has to do with the conventional means of scientific communication (books, journals of primary or secondary information), also exists with relation to other means such as direct contacts (congresses, symposia, small or large meetings, etc.). It is particularly serious in the case of costs of equipment which is essential for using special media of information.

Lastly, there is the matter of scientific planning and motivation. Information is the expression of what is being done in a given country which, in turn, produces scientific planning motivated on local problems. The search for information is

arduous for the scientist of an emerging country, since the problems to be solved by him are not usually matter of interest in the more progressive areas.

These suggested problems should undergo systematic research to determine whether the systems of scientific information created in the developed countries are adequate and useful to the developing countries and to what degree they satisfy the needs. Because of the obstacles for complete integration of information systems between the underdeveloped and advanced countries, it seems fitting to consider the possibility of the emerging areas creating their own autonomous systems. There is no question about the need for these countries to have an information system suitable to their needs and to their specific problems. I have already pointed out that without information there can not be scientific progress and one of the factors in the lack of scientific and technological progress of the underdeveloped countries is most certainly the deficiency or scarcity of such information systems. This situation is particularly serious in the case of technology applied to natural products which constitutes the economical basis of these countries.

The creation, implantation, and operation of scientific information systems in the more backward countries involve many complex problems. The first difficulty naturally is the limitation of financial resources. This limitation is felt in various ways such as the difficulty of creating and maintaining good libraries, cost of various types of equipment, and other financial outlays. But even more serious than the problems of financing are the matters relating to the cultural and educational structure which can hinder the installation of a scientific information system. Specially serious is the lack of group spirit among scientists of the underdeveloped countries. Their scientific associations are usually weak because, in addition to having few members, they meet infrequently. We consequently do not take advantage of an important element of scientific information which is direct and informal communication among scientists. This lack of group spirit, so frequent within a region or country, is also felt from country to

country. In the last few years there have been several attempts made on a national and international level to promote closer cooperation among the newly developing countries of the world. But the results are not yet encouraging. It seems that the underdeveloped countries are still in that period through which the present developed world passed in the seventeenth century and which Dedijer⁹ calls the "intellectual phase of the scientific revolution". We must speedily surpass the phase of verbal manifestations and give concreteness to the decisions.

Having discussed and answered the first three questions I now wish to consider the last hypothesis: the construction of a scientific information system in the newly developing countries connected with the more advanced countries based on an internal organization adapted to local characteristics. This latter organization should be national and, if possible, regional in scope. It should involve various underdeveloped countries with similar cultures and should be integrated in character so as to avoid wasteful efforts and resources. Underdeveloped countries often maintain overlapping agencies for the same purpose, operating in a parallel or concurrent manner. Instead of grouping material and human resources, these are scattered and efforts are wasted.

With respect to cooperation with the information programs of the advanced countries every effort should be made to give to them a bilateral character. This gives rise to the serious problem of poor or nonexistent publications in the underdeveloped countries¹². Cooperation in the information field is accomplished partially by the exchange of publications. But many publications in the underdeveloped countries are of inferior quality, are discontinuous, and are in languages not known in the developed countries. Thus one of the main mechanisms of interchange ceases to exist because one side does not have the basic materials for exchange. To accomplish the objectives under consideration there must exist considerable understanding on the part of the developed world, because col-

laboration should not be exclusively in the form of donations. Even though interchange is not accomplished on a level of equality it must be done on a level of reciprocity. We should keep in mind that the underdeveloped areas are sources of information which only they possess, and such information is essential for complete world scientific knowledge. Science is true science only when universal in nature and this objective can be attained only by incorporating and integrating the various areas of the world.

I make no claim of being exhaustive on such a complex subject. I merely wished to point out a problem. The important thing now is to study it carefully, analyse it from all aspects, investigate each phase, and arrive at a basis for solution. If this is accomplished, the expansion of scientific information in the underdeveloped areas will be one more important force on the march to progress.

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