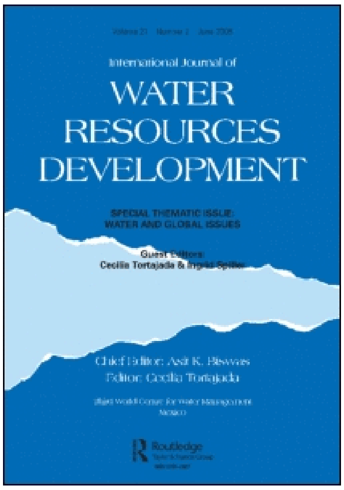

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Large-scale water transfers: emerging environmental and social issues

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Large-Scale Water Transfers: Emerging Environmental and Social Issues

IN OCTOBER 1977, a Task Force consisting of well-known international experts met at International Institute of Applied Systems Analysis, Laxenburg, Austria, to discuss and review the status of large-scale water transfers in different parts of the world and to make recommendations about possible future directions of work (Golubev and Biswas, 1979). One of the major recommendations of this Task Force was to hold another meeting at an appropriate time to review environmental implications of current and proposed large-scale water transfer schemes. It was also suggested that critical reviews of development on the subject would be desirable.

Nearly a year after the Task Force's meeting, International Commission on Irrigation and Drainage held a Special Session in June 1978 at Athens, Greece, on 'mass transfer of water over long distances for regional development and its effects on the human environment'.

Important developments in large-scale water transfers have taken place since these two meetings, both in terms of new projects for implementation and in terms of new ideas and perspectives. Accordingly, under the sponsorship of the United Nations Environment Programme, a group of international experts met in August 1983 in Hamburg, Federal Republic of Germany, to review and assess developments in large-scale water transfer. The present volume is the direct result of this expert group meeting.

Quantities of water used in all countries for various purposes have been steadily increasing in the past. The two major crises of the 1970s — food and energy — further re-emphasized the role of water control in economic and social development. Since nearly 80 per cent of water used on a global basis is for agriculture, and irrigation is a consumptive use of water whereas hydroelectric development is non-consumptive (and thus the two uses are compatible), water development plans accelerated during the 1970s — especially in developing countries — as nations attempted to become more and more self-reliant in food and energy production. This increasing interest is reflected by the total official commitments to irrigation to developing countries by bilateral and multilateral agencies, which amounted to $2.2 billion in 1980, a figure that was nearly three times the amount of only four years ago, $762 million in 1976. The total costs for the projects supported can be approximated at 2.5-3 times the amount of aid (Biswas, 1984).

Unfortunately estimates of water consumed in different parts of the world are not available, but some estimates can be made of water withdrawn. From a management viewpoint, however, it is desirable to know about water consumed as most water withdrawn can be re-used. Table 1 shows the average annual water withdrawn per unit of land areas by continents and selected countries (Barney, 1980). While water withdrawal in countries generally occurs in specific areas, and not uniformly distributed over their total land areas, Table 1, however, still provides some interesting facts. For example, it shows that the average annual water withdrawal in Brazil is only 1.18 per unit land area, but for Japan the corresponding figure is 301 mm, which can be attributed to the high rates of water withdrawals for cooling for thermal power plants, as well as for industrial and irrigation purposes.

Table 1. Average Annual Water Withdrawals per Unit of Land Area, and Total Water Use (Barney, 1980)

Geographical Area	Land Area (10^6 km^2)	Average Annual Withdrawals (mm/yr)	Total Water Use (10^9 m^3)
Africa	30.6	2.88	88
Egypt	1.0	30.0	30
Asia, excluding USSR	27.7	57.7	1597
India	3.29	9.12	386
Indonesia	1.93	3.11	42
Japan	.372	301	112
Pakistan	.804	147	118
Philippines	.300	46.7	14
Thailand	.514	38.9	20
Turkey	.781	28.2	22
Australia-Oceania	8.42	3.56	29
Australia	7.69	3.25	25
Europe	27.2	19.0	516
USSR (Europe & Asia)	22.4	13.2	295
North & Central America	22.1	24.9	551
United States	9.36	51.0	477
South America	17.8	3.20	57
Brazil	8.51	1.18	10
Global (excluding Antarctica)	134	21.2	2838

If the current trends continue, future water requirements of countries will increase substantially. As nations look for new sources of water which can be developed, and find that 'conventional' sources have already been developed or are in the process of development, they are forced to consider non-conventional alternatives like large-scale interregional water transfer. This is one of the primary reasons as to why several large-scale water transfer projects are being seriously considered in recent years in many parts of the world as possible alternatives. All the indications are that large-scale water transfer projects are likely to receive even more attention in the future than at present, especially in developing countries.

The present volume contains reviews of the latest developments in the area of water transfer for seven countries. These countries, in alphabetical order, are Canada, Hungary, Mexico, People's Republic of China, Sudan, USSR and United States. All these papers have been prepared by leading authorities in this field from the respective countries.

From an analysis of the papers contained in this volume it is evident that a considerable amount of experience now exists in large-scale water transfer in various parts of the world. In addition, many other such projects are now in prospect, which will undoubtedly contribute to a further increase in our knowledge.

It is clear that the first generation of water transfer projects in most countries were accomplished somewhat easily, since they were comparatively small and thus were not technically complex and were economically easy to handle. Furthermore, these projects generally tended to be within a single jurisdiction (say within a state or province) and were mostly completed before environmental issues became important considerations in the countries concerned. The new generation of water transfer projects, however, are generally large, technical problems which are not easy to resolve and implementation costs are high. They often span more than one province or state, and sometimes even more than one country, as is the case between Canada and the United States discussed in this volume. The institutional problems can thus become a major issue, and may prove to be more complex to resolve than techno-economical aspects. Environmental and social impacts assessment have also become crucial issues.

From the case studies reviewed, it appears that as large-scale water transfer projects are being considered for possible implementation, questions are being raised as to whether such transfers represent the best way of dealing with the problems that they are intended to solve, and if they do, whether the necessary institutional arrangements are in place to ensure their efficient implementation.

At the present stage of development, it is desirable to have a framework for evaluation to assess our experiences to date, which can also serve as guidelines for appraising proposals for future development. Ideally, such a framework should be able to produce answers to such questions as:

1. Is water transfer an inevitable strategy in certain circumstances?
2. Under what conditions does it represent the most efficient of alternative strategies?
3. What kinds of institutions – laws, policies, or administrative structures – favour (or impede) the implementation of water transfer strategies?
4. What kinds of trade-off must be considered in decisions relating to water transfers?

Various methodologies have been developed which could be used to provide answers to some of these questions. They include benefit-cost analysis, and environmental and social impact assessment. While each has merits as a tool for evaluation, each has a number of deficiencies, among which are:

- they take into account only a few of the relevant aspects;
- most are able to describe but not predict;
- the emphasis is on either physical attributes or economic dimensions with little attention to environmental and institutional aspects or behavioural considerations; and
- most existing methods deal with each aspect separately and few attempt integrated analyses.

Probably the most beneficial next step would be to develop such a framework in terms of guidelines for large-scale water transfer which can be used by developing countries that are planning or considering this type of project. If the guidelines are to be effective, they should have the following major characteristics:

– it would seek to explain why water transfers had been selected as a water and environment management strategy over other options and would attempt to predict their impact;

- it would attempt to identify the merits and disadvantages of water transfers as opposed to other options available for water management;
- it would indicate the kinds of trade-offs that have to be made when transfers are selected as a water and environment management strategy; and
- it would indicate the institutional factors which favour water transfers and those which discourage them.

Specifically, guidelines would take into account the following considerations that were identified by the Expert Group as being especially germaine:

1. Types of transfer (see paper by L. Dávid in this volume).
2. Institutional dimensions:
   (a) Political;
      power balance between the central, regional and local governments;
      political boundaries versus hydrological boundaries;

available channels for effective public participation.

(b) Legal;
existing water laws and rights;
interprovincial water agreements and/or relations;
international water agreements and/or relations.

(c) Institutions;
central water authority/(ies);
regional water authority/(ies);
local authorities.

3. *Environmental impacts:*

(a) Distinction should be made between impacts of water transfer and impacts of water use after the transfer.

(b) Environmental impacts should be carried out specifically for three components:
exporting area;
importing area;
link path between the two areas.

(c) For each component, impacts should be considered on:
(i) *Physical system:*
Water quantity: level; discharge; velocity; groundwater; losses.
Water quality: sediments; nutrients; turbidity; salinity and alkalinity; temperature effects; toxic chemicals.
Land implications: erosion; sedimentation; salinity; alkalinity; waterlogging; changes in land use patterns; changes in mineral and nutrient contents of soil; earthquake inducement; other hydro-geological factors.
Atmosphere: temperature; evapotranspiration; changes in micro and macroclimate:
(ii) *Biological system:*
Aquatic: benthos; aufwuchs; zooplankton; phytoplankton; fish and aquatic vertebrates; plants; disease vectors.
Land-based: animals; vegetation; loss of habitat; enhancement of habitat.
(iii) *Socio-economic system:* Production; agriculture; aquaculture; hydropower; transportation (navigation); manufacturing; recreation; mining.
Socio-cultural: social costs, including re-settlement of people; infrastructural developments; anthropological effects; political implications.

4. Alternative strategies:

(a) Conventional:
efficient use of water:
changes in water use, changes in allocation, changes in utilization (e.g. cropping pattern);
demand control – economic, legal, institutional, technological.

(b) Nonconventional:
re-use of water – sewage, drainage, waste water;
desalination: brackish, sea water;
weather modification.

5. Motivations for adoption of water transfer, and perception and attitudes of people to transfer:

(a) Perceived a real need for water for social and economic development.
(b) Political considerations.
(c) Provision of accurate information on all aspects of water transfer, and processes to disseminate that information.
(d) Perception of politicians, bureaucracy, and various pressure groups (environmental, labour, business, etc).
(e) Perceived national interest, especially for international cases.

Finally, the importance of continuous monitoring and evaluation for large-scale water transfer projects must be stressed. It is not enough to carry out social and environmental impact analysis prior to the construction of projects. As with any major system that is constituted of a series of interacting and interrelated variables, it is not possible to predict with absolute accuracy the impacts of a large-scale water transfer project prior to its construction. Risks and uncertainties are inherent in such analyses. Thus, it is absolutely essential that monitoring and evaluation become an integral part of the management process from the implementation phase in order to ensure that the future stream of benefits occur to the right target groups on the planned time schedule, and the costs (economic, social and environmental) are kept to a minimum, at least within the expected limits foreseen during the planning phase. If monitoring and evaluation is accepted and used as a management tool, timely corrective actions can be taken for maximizing positive project impacts and minimizing adverse effects, both of which will contribute to achieving the project impacts.

Because of massive investments necessary for the present-day large-scale water transfer projects, monitoring and evaluation issues have assumed greater importance in recent years than ever before. This means that adequate funds must be specifically designated for establishing a monitoring and evaluation system from the very beginning and not as an afterthought when serious problems surface. Such a process will contribute to efficient management, which can then take appropriate actions as soon as problems surface.

References

Barney, G.O., *The Global 2000 Report to the President of the United States: Entering the 21st Century*, Vol. 1 (Pergamon Press, Oxford, 1980), pp. 147-49.

Biswas, Asit K. Water Where It's Wanted, Development Forum, (August-September 1983), p. 5.

Biswas, Asit K., Zuo Dakang, Nickum, James E., Liu Changming *Long-Distance Water Transfer: A Chinese Case Study and International Experiences*, (Tycooly International, Dublin, 1983), 417 p.

Golubev, Genady N., & Biswas, Asit K. *Interregional Water Transfers: Problems and Prospects*, (Pergamon Press, Oxford, 1979) 158 p.

International Commission on Irrigation and Drainage (ICID) Proceedings of Special Session on Mass Transfer of Water Over Long Distances for Regional Development and Its Effects on the Human Environment, (ICID, New Delhi, 1978), 243 p.