THE RESOLUTION OF INTERNATIONAL WATER CONFLICTS: A COMPARATIVE STUDY

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International conflicts over the use of shared river basins have created increasingly serious problems in recent decades. This paper examines a neglected aspect of the management of such conflicts: the impact of the intranational decision making process within each of the countries in conflict on its negotiation of critical water resources issues. An analytical model of the policy process that governs the resolution and/or management of an international river basin conflict, applicable to countries at any level of development, is presented. The model represents a cycle that begins with the identification of needs requiring official government action, and ends with the production of policy outputs to allocate resources for the satisfaction of the identified needs. The model is applied in this paper to resolutions of two major conflicts in separate international problem areas: disputes over the use of Nile River waters by Egypt and the Sudan; and the negotiations that took place between Brazil and Paraguay for the approval and construction of the Itaipu hydroelectric project.

Sources of Conflict

Since nearly 40% of the population of the world lives in river basins shared by more than two nations, any conflict involving these resources is of great importance to the countries concerned and to world order. The dimension of the problem may also be measured by the number (214) of shared river basins in the world as identified in 1977 by the United Nations. Of those, 155 are shared by two co-riparian countries, and the rest by three or more nations. One European river, the Danube, runs through 12 countries. In Africa, there are 56 shared river basins; in North and Central America, 34; in South America, 36; in Asia, 40; and in Europe, 48. Of these, Africa has 12 river basins that are shared by four or more countries. South America has two, Asia five, and Europe, four. Except in Europe, signed agreements control the use of few of these river basins.

Over the years scholars and administrators have contributed to an extensive body of literature on the evolution and settlement of conflicts over the use of these river basins, and legal experts have developed sets of judicial principles to guide the apportionment of the resource. Taking into consideration the knowledge accumulated throughout all these negotiations, a consensus has emerged on the factors that have affected and may influence present and future settlements. Some of these factors are:

1) the gaps between countries' intra- and international goals and aims;
2) real or perceived inequities in the allocation of resources;
3) often inadequate scientific input into the political process that may result in faulty agreements;
4) poor enforcement of agreements when the institutional arrangements for implementing policy are inappropriate;

5) environmental cost/benefit, or risk/cost/benefit analysis, especially for future development, often not carried out before an agreement is reached; and now emerging
6) the lack or inappropriateness of international and national regulation on discharges of pollutants and groundwater uses.

But the main cause of conflicts among nations sharing river basins is and will continue to be the difference in the approach to and the resources for economic development of upstream and downstream nations. Even when there is a mutual interest in developing a shared river basin, the individual interests of the countries may take quite a different form and outlook from one reach of the river to the other.

A review of agreements now in effect shows that for the most part a high priority has been assigned to offstream uses, with critical instream values generally ignored. This will be a future source of problems. The allocation and contamination of groundwater also are emerging as significant issues, especially in the dry areas of the world. Old agreements will have to be reviewed for a variety of reasons, e.g., the increasing differences in the rate and kind of economic development, population growth, and land uses between countries sharing river basins; and because of growing water quality problems. It appears that the latter will be a far more difficult issue for negotiation than the allocation of water supplies.

Settlement of Disputes

Parties in dispute have taken advantage of principles of international law and the mediation tools offered by international organizations. The general international principle followed by river-sharing countries provides that no diversion or manipulation of water of international rivers can be carried out by one riparian state without the consent of the other riparian state. This means that in trying to reach agreements, nations look for ways in which the rule of equitable apportionment is applied, where every unit gets a fair share of the water of the common river. A related, universally accepted principle prohibits an upstream nation from changing the natural condition of river water to the serious injury of the downstream nation. In the majority of cases, the old private law doctrine of riparian rights does not apply. Absolute territorial sovereignty would allow every state to inflict irreparable damage on its neighbors, inhibited only by the threat of war.

Recently, international organizations have been grappling with problems of drought and the availability of clean drinking water for ever growing populations; the resolution of conflicts over shared river basins is therefore steadily increasing in importance.

Legal and institutional analyses (Teclaff, 1972; UNDSA, 1975) provide some details on the intra- and international policy processes involved in settlement. Conceptual frameworks, matched with case studies, have sharpened the understanding of the factors facilitating settlement (LeMarquand, 1977). For the most part, these works have been descriptive or didactic rather than analytical. More recently a number of scientific and technical studies have described ways in which management of hydrologic conditions can fulfill

the economic development demands of the countries involved. Multiple disciplines are frequently involved in this "holistic" type of analysis: mathematics, economics, engineering, hydrology, among others. The rapid development of mathematical modeling for river basin management has increased the reliability of the methodology and its capacity to respond quickly to questions as negotiations progress. The technique has been developed in Western industrialized countries but has by no means been limited to them (Major and Lenton, 1979; Stone, 1977, 1980).

The Need for a New Concept

A review of the literature suggests the need for a concept that will bring together the body of knowledge that these works constitute. Negotiating teams until now have paid far more attention to the socio-economic systems of the countries involved than to the political processes that produce the intra-national decisions determining the outcome of negotiations. The limited policy analysis performed in this area has generally used analytical models in the rational, Leibnitzian mode, which typically are limited to solving a resource allocation or material flow problem, or perhaps a combination of the two.

In brief, a research design is needed that will accommodate the decision-making processes of any country at any level of development, regardless of its background in law or custom; and that will explain the impact of governmental decisions on international conflicts (LeMarquand, 1977).

Policy Systems Model

At a recent meeting of the United States Universities Council on Water Research, one expert cited as a major need research that would relate "the technical dimensions of mathematical modeling of water resources systems with interactive computerized systems that decisionmakers can use to evaluate the consequences of their decisions in terms they can understand" (Veissmann, 1985). The model presented in this paper is intended to be at least a first step in this direction (Figure 1). It derives from the work of David Easton (Easton, 1965) and emphasizes the role of the bureau (administrative unit) as the producer of outputs, policy or program, affecting the needs in the "environment" of a political subsytem (Figure 2). This policy process generally consists of an array of overlapping subsystems. Issues activating each subsystem may be broad, involving a number of bureaus; or they may be narrow, involving a small organization. The policy subsystem model used in this analysis refers to decisions made by a national government, but it adapts readily to the analysis of decisions made at the regional or local level.

The model provides the opportunity to identify, factually, the decisions made by sets of actors involved in the political process with respect to the resolution of river basin conflicts. The policy subsystem reacts to its environment, where the need for a governmental action has surfaced. Inputs into the political process include demand for action as well as for resources to achieve the stated goal. In theory, the policy subsystem could react in an ideal fashion to balance outputs, policy, and programs

with the needs that have arisen in the environment. In practice, the subsystem reacts differently in each situation, responding to a number of complex variables within the subsystem as well as in the environment. The model provides the means to categorize information about decisions, to suggest the basis for compromises achieved, or the reasons for their failure. While quantification of data is limited by the nature of the process and results, the relationship between actors in the subsystem can be recorded and evaluated. The possibility of projecting the kinds of decisions that will help to complete settlement is implicit in the model but many empirical data are needed before forecasting can be attempted.

The analytical framework demonstrates that:

1) Need for governmental action emerges in the environment and is recognized and defined by the public and private sectors; some needs can be expressed in quantitative terms.

2) Goals are then set, with inputs from authorities, commissions, academic sources, individual experts, public and private organizations, etc.; general demands result from this part of the process.

3) Specific requests are made at this point for executive, legislative, or judiciary action by the influencing agents who represent the interests of party, public and private special groups, media, etc.

4) The decisionmakers in the executive, legislative, and judicial branches of government then take action by setting policy and by allocating authority and resources to bureaus to implement the developed policy.

5) The bureau is assigned responsibility for implementing policy by performing the following basic functions (outputs):

   a) funding or providing the means to plan, develop, operate, and/or manage programs, projects, facilities, etc.;

   b) regulating public and/or private activities;

   c) conducting or supporting research and data gathering; and

   d) providing technical assistance to improve public or private activities.

6) The outcome of the bureau programs may or may not be in accordance with the intended effects. In any case feedback into the political system takes place as changes occur in the environment of the subsystem.

The application of the model to the resolution of international conflicts requires the addition of another "bureau" responsive to the policy subsystems of both countries (Figure 3). Traditionally, settlements include the establishment of such a body, frequently called an international commission (Murphy and

Sabadell, 1985). In the discussion of the following two cases such administrative units were established by treaty between the countries involved. The case studies are each presented in two parts. First, the importance of the shared water resources to the countries competing for it is described. Second, the relationship of each governmental action to the outcome of negotiations and the terms of the respective agreements is summarized. Because of space limitations, the analyses suggest rather than explore in detail the relationship between the intra-national decisionmaking processes and the outcome of negotiations.

Egypt, the Sudan, and the Nile

The Need for River Control

Limited control of the periodic flooding of the Nile delta in Egypt occurred millenia before the development of modern river management technology. The river irrigates a flood plain strip 16 to 20 kilometers wide, an area that has often been referred to as the world's largest oasis. Beginning a century and a half ago the first efforts were made to increase agricultural production along the Nile, particularly of cotton. More intensive irrigation was required, including the digging of additional channels and the construction of barrages and diversions for larger reservoir storage. While these efforts had their start in Egypt, the neighboring country of Sudan also began to modify the flow of the river to accommodate changes in agricultural use. Inevitably, some kind of formal agreement about the development of the river and the allocation of its waters had to be reached.

The first agreement between the countries was signed in 1929 while each was still a protectorate of Great Britain. A second agreement followed 30 years later after each had achieved independence. Still in force today, the 1959 pact has endured the stresses and strains of internal political upheavals in both countries and their neighbors. It should be noted that in this case and contrary to the norm, the downstream country has been the stronger negotiator and by far the most favored in both agreements.

A 1902 agreement, signed by Ethiopia and the United Kingdom (on behalf of its two protectorates, Egypt and the Sudan) provided for negotiations on the development of the Nile River by the respective countries. Since that agreement, however, neither Ethiopia nor any of the other riparian countries has been party to negotiating the allocation of Nile waters. This is in spite of the fact that 80% of the river's waters reaching Egypt originate in Ethiopia (Okidi, 1982).

The Impacts of Development

With the construction of the first Aswan Dam in 1902, Egypt began a steady increase in its production of marketable surplus crops. At the same time a significant rise in population started, causing a tripling of the population during the first half of the 20th century. During this period, Anglo-Egyptian authorities in the Sudan sought a greater degree of economic

coexistence than was ever to occur. The concept for Nile development that received the most support, the Century Storage Scheme, put forward by a British expert working for the Egyptian government, involved the construction of separate, relatively small-scale storage capacity dams at Aswan and downstream. The scheme, which was never implemented, would have divided the river's resources so that the waters of the White Nile went to Egypt and those of the Blue Nile to the Sudan. The proposal was highly favorable to Egypt, since it would also have received flooding surpluses of the Blue Nile. Details of the development of the Nile as well as the resolution of conflicts over it may be found in Waterbury, 1979; Okidi, 1982; and Abdalla, 1971.

As projects were developed, an increasing number of questions was raised about the need for a formal agreement on the allocation of the river's resources. Negotiations for the 1929 pact were carried out by the government formed in Egypt under British guidance and a representative of the British government for the Sudan. The President of the Egyptian Council of Ministers made it clear that his country would expect to negotiate with the Sudan itself at some time in the future and that the 1929 agreement was considered to be temporary. The agreement defined Egypt's "acquired rights" as 48 billion m^3 per year and the Sudan's as four billion m^3. The entire flow of the main Nile was reserved to Egypt during the "timely" growing season, from January to July of each year. The terms were generally unfavorable to the Sudan, providing, for example, for the stationing of Egyptian inspectors at Sudanese development sites. In 1932 a formal agreement was reached to acknowledge and support the construction of a dam 45 kilometers upstream from Khartoum, as part of the Gezira Cotton Scheme, designed to improve the development of surplus, marketable crops in the Sudan (Waterbury, 1979).

Governments and Decisions

A military coup in 1952 virtually ended British rule in Egypt, replacing it with a nationalist, revolutionary government led by Gamal Abdul Nasser. A Revolutionary Command Council was created and the 1923 constitution promulgated during British rule abrogated. In June of 1953 the Republic of Egypt was established, with Nasser becoming its first Prime Minister and, in 1954, its President. A new constitution was adopted in 1956.

The Sudan was not unified until the early 19th century when Nubia was occupied by Egyptian gold and slave traders. Khartoum, located at the confluence of the Blue and White Niles, was founded by them in 1823. A tribal revolt that began at the turn of the century was crushed after 16 years by an Anglo-Egyptian army. In 1923 and later in 1936, the Egyptians and British signed an agreement to share rule over the Sudan, officially called the Anglo-Egyptian Sudan. By 1948 moves toward independence resulted in the establishment of a predominantly elective legislative assembly with half of its membership Sudanese. The first assembly elections were a substantial victory for the Independence Front party, which favored independent status rather than union with Egypt. With British and Egyptian concurrence, an all-Sudanese assembly was elected in 1953 and an independent republic established in 1956. An army coup, led by General Ibrahim Abboud, established

military rule in the Sudan in 1958. Parliament was dissolved and the constitution adopted under British-Egyptian rule abrogated.

Independent, nationalist, military governments were established in both countries during the 1950's, as each experienced an accompanying push for increased economic development. Inevitably that meant additional efforts to manage the Nile. The Sudanese and the Egyptians both made long-range economic plans to carry out their respective growth strategies.

Egypt's "revolutionary" plans included land reform in 1952; the elimination of British, French, and Belgian interests in the non-agricultural sectors; and the establishment of capital development goals to develop and increase its industrial sector.

Decisionmaking about the allocation of Nile waters and other matters thus was in the hands of strong, pragmatic rulers with little influence from traditional power elites and other groups that might have wanted to affect these decisios. Throughout this period Egypt was by far the stronger of the two countries, economically, militarily, and politically. To build the Aswan High Dam, however, it had to come to terms with the Sudanese. At issue were: 1) the resettlement of the Sudanese population that would be displaced by the reservoir (land areas would be submerged for a distance of 170 kilometers in the Nile Valley); 2) compensation for material damage suffered during and after construction; and 3) the establishment of a new water allocation formula.

Negotiations began in 1954, with Egypt asserting that it had a much greater need for water resources because of a larger population, greater current and potential economic development, and a unique dependence on the river. Egypt also argued that the Sudanese needs were much smaller, as they had developed only the rudiments of irrigated agriculture and had the climatic conditions for expanding rainfed crops. The Sudan, in turn, claimed that by 1951 it had exhausted its share of Nile waters. This led to a temporary increase in its allocation, agreed to by both parties.

Throughout the negotiations it was obvious that neither side had obtained accurate information about its future water needs. It was later found, for example, that the Sudanese had not accurately estimated the impact of the construction of the High Dam on their land and people. The Sudanese objected that their needs had been understated during the 1950's negotiations, and disputed the factual material presented by the Egyptians about Nile flow as well as the estimates put forward about the size and rate of growth of the Sudanese population. By their own criteria the total water that should be available to Sudan was 15 billion m^3 annually, rather than the eight billion m^3 claimed to be sufficient for them by the Egyptians. The Sudanese also disputed the hydropower that would be generated by the dam, claiming that it had been overestimated, and that the cost of construction would be greater than that for the Century Storage Scheme of the 1920's.

Talks were interrupted and not resumed until early 1959. In the meantime France, Israel, and Great Britain had attacked the Canal Zone (November 1956) and Egypt began seeking improved relations with the Soviet Union. Egypt also exerted its strength over the Sudan, sending in a military force at the time of that country's parliamentary elections in 1958. The Sudanese

responded by voting an anti-Egyptian party into power. A military coup followed. Shortly before this the Soviet Union had informed Egypt that it would fund the High Dam. With the construction of the dam assured and a pragmatic military regime in power in the Sudan, negotiations on the conflict over the Nile basin were resumed.

Initially, the Sudanese negotiators proved to be hard bargainers. Sudan, in effect, had abrogated the 1929 agreement by raising the level of the Sennar reservoir for its own use, thus depriving the Egyptians of an allocation guaranteed by the earlier treaty. When the Egyptians laid claim to two Sudanese border territories, the "hard-headed Premier sent troops to the disputed territory.... When the Sudan called for the intervention of the Security Council, Egypt allowed the crisis to die away as fast as it had arisen..." (Abdalla, 1971).

Relations in the early fall of 1958 remained difficult. The Sudanese Premier was feeling pressure both from his own party and opposition groups, as well as the economic depression resulting from poor cotton crops. A coup d'etat led by the Premier with six top Army officers took place. A new government was formed and its leaders proceeded to settle unilaterally many vexing problems, one of which was the resolution of the Nile conflict.

Nasser immediately recognized the new government and negotiations moved briskly. He needed a quick settlement since he was about to sign (December 1958) an agreement with the Soviet Union for a loan of 400 million rubles to construct the first stage of the High Dam.

By 1959 the "Agreement for the Full Utilization of the Nile Waters" was signed; it provided that:

- Of the estimated total of 84 billion m^3 per year agreed upon as being available to both countries, Egypt was to receive 55.5 billion m^3 and the Sudan 18.5 billion m^3 (an estimated 10 billion m^3 would be lost by evaporation and seepage).

- Because the Sudan could not use that much water at the time, it was agreed that it would provide Egypt with an annual loan of 1.5 billion m^3 each year through 1977.

- Any increase in the natural flow of the river would be shared 50-50, and not in proportion to their respective shares.

- The costs of Upper Nile water projects were to be shared on an equal basis.

- Compensation would be paid to the Sudan by Egypt for the relocation of 50,000 Sudanese required by the construction of the High Dam.

A Permanent Joint Technical Commission was established to implement the agreement. The Commission is composed of an equal number of members from each country and supervises the administration of the Agreement, including

the gathering of hydrologic data to support implementation and determination of allocations in case of water shortages. It also has the power to formulate negotiating positions for both countries with respect to the possible demands of other riparian states.

Future Problems

The 1959 agreement has worked until now, yet there are reasons to be concerned about its future. Major questions that may have to be faced include the following:

1. Will the allocation of water, presently heavily favoring Egypt, have to be revised if the needs of either or both countries change?

2. What effect will outside forces influencing the military and economic strength of both countries have on the need to change the present agreement?

3. What impact will internal economic and political developments within each country (drought, insurrection, and weakened governments) have on the agreement?

4. What effect will water quality issues, not addressed in the 1959 agreement, have on future relationships between the Sudan and Egypt? Or between these two countries and the other upstream riparian countries?

5. What impact will the agricultural development of other riparian nations have on future demands on the Nile, particularly in view of possible long-term continental drought and widespread famine?

Brazil, Paraguay, and the Parana

The Need to Develop the Parana

The Parana River basin covers an area of 3,225,000 square kilometers. It is part of the basin of the Rio de la Plata, and runs through several countries, forming a boundary between Brazil and Paraguay, and Argentina and Paraguay. It then joins the Uruguay River to flow into the Rio de la Plata. It is altogether 4,000 kilometers long, the seventh longest river in the world, with several important tributaries. Of greatest interest to Brazil because of the possibility of harnessing the power potential of the Parana's El Salto del Guaira (in Portuguese, Sete Quedas), the largest waterfalls in the world, the river also offers land-locked Paraguay an opportunity for an outlet to the Atlantic.

The Guaira Falls site has created problems for Brazil and Paraguay since 1872. In the aftermath of a bloody war begun by the latter to assert its rights in the area, a treaty was signed in 1874 which established a new border between the two countries. During the meetings of

the Joint Demarcation Committee set up by the treaty in 1874, a "split" in the river above the Guaira Falls was discovered, creating a boundary dispute that has not been resolved. The construction of the Itaipu Dam (completed in 1984) mooted the question since the whole area has disappeared under the waters of the lake formed by the dam.

In 1932, following yet another conflict between Paraguay on the one hand, and Brazil and Argentina on the other, the two latter countries and Uruguay agreed to adopt the general principles of international law as they applied to the sharing of river basins. These principles provide for consultation between co-riparian states. The Permanent Commission of International Public Law of Rio de Janeiro followed through on this agreement with a 1933 report espousing these principles. Shortly thereafter Brazil, Argentina, and Uruguay signed the 72nd Declaration of Industrial and Agricultural Use of International Rivers, agreeing to the principle of consultation among co-riparian countries before the construction of major waterworks and to support procedural mechanisms for implementing them.

Since the late 1950's, Brazil's need to overcome fossil fuel shortages and to ease its dependence on imported oil emphasized the potential advantages of hydroelectric development of the Guaira site. By the mid-1950's Brazil had already constructed a network of hydroelectric projects on nearby river basins and on the Parana itself, but the need for further development made the Itaipu complex a high priority for the country. Negotiations with Paraguay thus became imperative.

Governments and Decisions

The political history and economic development of Brazil and Paraguay in recent decades are closely interconnected and there are certain remarkable similarities between the development needs and political processes of both countries. Each reflects a popular interest in representative democracy, but each succumbs periodically to highly centralized governmental control at considerable sacrifice to freedom of political action.

Prior to the negotiations between Paraguay and Brazil which culminated in an agreement for the building of a dam at Itaipu, a military coup in 1964 replaced a period of moderate democratic rule in Brazil (from 1946 to 1964). A strong, highly centralized regime took over, opposition was outlawed, and considerable repression was experienced in the country until the beginning of abertura in the early 1980's, and the return to a democratic system of government in 1984.

For more than three decades Paraguayan rulers and Brazilian political leaders tended to increase the power of their respective national governments' executive branches. Even though both countries are loose federations of regional units or provinces, decisionmaking has been controlled by the national executive branches, strongly influencing both the legislative and judicial bodies.

Within Brazil, the "influencing agents" with immediate effect on the decisionmakers were members of the military and business leaders with

significant stakes in intensive efforts to step up economic development. Conflicts arose primarily between those who wanted Brazil's place in the international community enhanced, even by sacrificing immediate national goals, and those who wanted to concentrate on domestic problems. In any case, the development of the "Brazilian model" was pursued relentlessly in the decade following the 1964 military coup under the leadership of General Medici, and later, that of General Geisel. The impacts on national and foreign policy of these regimes is followed in detail in Flynn (1978).

Paraguay's political development has been summarized as follows:

> Since independence (from Spain) the country has alternated between short periods of turbulence and longer periods of authoritarian rule; changes of government among political parties have involved the use of force, and elections, when they have taken place, have usually featured a single slate of candidates. (Area study, 1972, p. 143)

Paraguayan efforts to become a power among Rio de la Plata neighbors led to disastrous defeats at the hands of its neighbors during the last century, in the bloodiest wars experienced in Latin America. A strong leader, General Alfredo Stroessner, came to power in 1954. The establishment of democratic institutions was encouraged during the 1960's, but all along protests against an economic system that concentrated its profits in the hands of a few, and a political system that limited freedom of speech and action, were consistently repressed. As a result, there has been little public participation in the country's decisionmaking processes.

Antecedents to Itaipu

Having achieved a measure of domestic stability by the mid-1950's, Paraguayan leaders turned to foreign policy objectives. Conscious of the need to maintain friendly relations with Brazil and Argentina so as to share resources and secure outlets to the Atlantic, Paraguay participated in all the negotiations concerning the use of international rivers from the early 1960's on.

Beginning in the late 1950's and throughout the 1960's, Brazil displayed an equal interest in negotiating conflicts arising in shared basins. It conferred with Uruguay and Argentina, for example, about the Uruguay River, although Brazil was not directly affected. Even though development took place downstream from Brazil, the three countries agreed in 1960 to a joint plan for development. Brazil supported the concept of peaceful resolution of international river basin conflicts in other ways. In 1963 it asked the Organization of American States to organize a special conference for the specific purpose of examining agricultural and industrial development of South American international rivers. In 1965, at the Second Extraordinary Inter-American Conference, held in Rio de Janeiro, a resolution was adopted to convene a special conference to discuss concepts and rules concerning the use of international rivers, ways to delimit powers, and the groundwork for a convention to rule definitively on this matter. The Helsinki "fair-share" rules adopted by the International Law Association in 1965 as well

as "previous consultation" rules were accepted as the initial steps towards the establishment of an international doctrine.

On the other hand, Brazil's desire to dominate the Parana-Itaipu development was apparent at an early stage. In 1962 it had claimed complete sovereignty over the Guaira Falls in a diplomatic note to Paraguay. The note was rejected by Paraguay but in 1964 it agreed to the establishment of a joint committee to examine the hydroelectric potential of the Guaira Falls. The new military regime in Brazil, however, acted unilaterally and invaded the disputed territory, built several pontoon bridges over the falls, and established a military post in the area under negotiation. The Paraguayan government complained diplomatically to Brazil over these actions, as well as the construction of permanent buildings and roads by military engineers, and the settlement of the area by Brazilian nationals, but stronger actions were not taken. One reason may have been that Paraguay's leaders were strongly motivated to complete an agreement that could provide the opportunity to share in the resources provided by the Falls.

In June 1966 both countries signed the Act of Iguazu, providing that they would jointly examine the hydroelectric potential of the 200 kilometer reach of the Parana River between the Falls and the Argentine border. They also agreed that any electric power produced on the site would be equally divided between the two countries. At the same time, Brazil ceased its military occupation of the area under dispute, leaving only a police and customs station. The following year the Paraguay-Brazil Technical Commission was formed and the implementation of the Act of Iguazu begun.

In 1970 the Paraguayan and Brazilian electric companies (ANDE and ELECTROBRAS, respectively) were formed, and a three-year study was contracted to two companies, one from the United States and one from Italy, to determine the technical and economic aspects of dam development at the Saltos de Guaira site.

The Treaty of Itaipu

In April 1973 the Presidents of Paraguay and Brazil signed the Itaipu Treaty, agreeing to build the largest hydroelectric power project in the world with a capacity, when complete, of 12,600 megawatts, more than five times the capacity of the Aswan Dam in Egypt, and about 25% of the total built hydropower capacity of Brazil. This treaty was the implementation of the Act of 1970, with terms highly favorable to Brazil.

Criticisms of the treaty were raised almost immediately in Paraguay and elsewhere, many of them centered on its financial terms and the preferential treatment given to Brazil. In Paraguay much attention was given to the fact that the treaty was negotiated in secrecy, disclosed to the press only after it had been signed, and that very few people in the Paraguayan government were involved in the negotiations. Several editorials in Paraguayan newspapers in April 1973 were critical of the lack of public participation, pointing out that the affected population was not consulted, and national technological capabilities and materials available in the country had not been measured, thus giving the advantage to the other side in the

negotiations. It was noted that Brazil knew exactly what its plans for economic development were, contrary to Paraguay, where such plans had not yet been made, and that the objectives of the Paraguayan government seemingly did not go beyond selling the electricity produced to Brazil.

To implement the treaty, a Council of Administration and an Executive Directorship were established, each composed of an equal number of representatives from each country. Article 11 stated that insofar as possible, labor (specialized or not), equipment, and materials from both countries would be used in the construction and maintenance of the dam in equal parts. Article 13 established that the energy produced would be divided equally between the two countries, but it was also stated (in Article 14) that each was to have the right to acquire the energy not used by the other country for its own consumption. Thus Paraguay and Brazil agreed to buy, together or separately, the total amount of energy produced, eliminating the possibility of exporting energy to third parties. It was also agreed that national energy requirements for each country had to be determined in advance, for 20-year periods, the first chronogram to be prepared before installing the first turbines.

Annex C, the most important part of the treaty, provided for the financial basis on which the complex was to be built and how its output would be allocated. It also established the method by which the sale price of electricity produced would be determined, taking into account: 1) costs of production; 2) a 12% return on the principal; 3) finance charges and amortization; 4) royalty payments to each country for the use of water resources; 5) administrative charges for both electric companies; and 6) in the event of one country selling electricity to the other, compensation for the ceding country calculated at a specified rate. All payments were linked to the U.S. dollar.

Comments on the Treaty

Even though the concept of parity was expressed throughout the document, the outcome benefitted Brazil to a substantial degree. The main reason was that Brazil was the only one of the two countries with the scientific and technical capabilities in place to determine its energy needs and to plan the project. Similarly, on the financial side it was agreed that any loans for the construction of the dam would need the prior approval of the Brazilian government. Loans went through Brazilian financial markets with the government guaranteeing them, thus ensuring that interest on the loans remained in the country. Brazil underestimated the total cost of the project, setting it at two billion dollars in June of 1972; cost overruns had raised that figure to an estimated 17 billion dollars by early 1982. Much of this overrun was due to inflation and growing interest rates on loans, but Brazil was very determined to build the dam quickly even if it meant greatly increased costs. This put Paraguay in an even more difficult position, as they are obliged to pay half of the cost of construction, and can probably only will do so by exporting a larger share of electricity to Brazil, thus delaying any expectations of profit.

Brazil is also benefitted by another term of the treaty, which establishes that compensation for the selling of one country's share of electricity

to the other has to be paid by both. Thus, half of any compensation for the electricity sold by Paraguay to Brazil is paid by Paraguay itself. It has been estimated that only by selling all of its share of the electricity produced at Itaipu would the Paraguayans start to receive some real return from their investment. Further, it has been calculated that Paraguay will receive only one-third of the estimated 30 million dollars of annual income from the partnership, since it will use only a minimal part of its share of the electricity produced. As the treaty was signed, the petroleum embargo began and the world price of oil increased dramatically. The provisions of Article 13 were even less profitable for Paraguay than before the embargo started, particularly since the price of electricity had been determined on a capital investment of two billion dollars instead of the much larger investment that was actually needed.

There is no doubt that for the depressed economy of Paraguay the construction, maintenance, and operation of the Itaipu Dam was an economic boon, but this has now slowed, and the benefits have been fewer than they might have been with better planning, using sound, broad-based, and timely inputs. Two primary strategies for dealing with this situation have emerged: 1) Paraguay could start a crash program of economic development, therefore using more of its share of the electricity produced; and 2) it could continue to sell electricity to Brazil at the same rate, in effect making Paraguay the world's leading exporter of hydropower, but persuade Brazil to revise the price scheme. Pros and cons have been put forth for both, but one of the main problems forestalling development in Paraguay is the great cost of financing the high voltage transmission and distribution lines needed to increase energy consumption. In the present condition of world financial markets, with high interest rates and an enormous international debt to service, it is almost impossible for Paraguay to find the needed capital for this investment.

Therefore, little has been done to improve the Paraguayan position in the partnership, and it was not until July 1980 that Paraguay formed a National Energy Commission to deal with problems related to its national development. In addition, Paraguay was to have informed Brazil in 1983 on its energy needs for the next 20 years, but so far has failed to do so. Despite repeated requests from the Industrial Union of Paraguay for the government to determine the exact sale price of electricity from Itaipu to Brazil, this also has not been done, in effect constraining the influx of capital investment into Paraguay.

As a further result of the treaty and subsequent construction of the dam, migration of Brazilians into Paraguayan territory around the dam has accelerated. The settlers are not only construction workers, but also farmers attracted by the plentiful supply of water provided by the dam. At present several hundred thousand Brazilians, more than one tenth of Paraguay's population, live in the eastern provinces, farming what was until the early 1970's an inpenetrable forest. These new settlers are an economic-political force that will no doubt have an influence on future policy decisions.

Brazil, in its quest for cheaper energy, wants to develop all its hydropower capacity but, given the experience of the implementation of the

Itaipu treaty and the changing world financial environment, future negotiations over international river development, whether bilateral or multilateral, will face ever increasing difficulties. One example of the more cautious approach to negotiations for this kind of development in the area is provided by the treaty signed in 1973 between Argentina and Paraguay for the Yacyreta-Apipe hydroelectric project. The treaty provides that neither party need sell electricity surpluses to the other. The basis for calculating the selling price of electricity is considerably tighter than in the Itaipu case, with a higher base price as a result. In addition, this price is not tied exclusively to the U.S. dollar but to a basket of international currencies.

From the two cases presented and from other negotiations that have taken place during the last decades in the development and use of international river basins some general observations can be made:

- Negotiating countries seldom are at equivalent points in their economic and political development and power.
- Further, they may want to grow in different directions, on different timescales, and by different degrees economically, socially, and environmentally.
- Even though allocation of surface water, hydropower, irrigation, and navigation have been the main subjects in negotiations between countries, issues on groundwater resources and the quality of water will be, if they are not already, the next source of serious intra- and international conflicts.
- The goal of the international community is to resolve this type of conflict in an equitable manner regardless of the location (up- or downstream) of the countries involved and their power status. It is possible, however, that this goal may not necessarily be shared by the contending countries.
- Internationally accepted guidelines and concepts have not been observed in all cases, nor have they been universally recognized by all countries.
- Information needed by planners, politicians, administrators, negotiators, the public, etc., is generally sketchy, of poor quality, not presented in a timely fashion, and in many instances, inappropriate, constraining more than enhancing the conflict resolution process.

The model presented in this paper and the two case studies illustrating it emphasize the need to consider decisionmaking processes within each country and their influence on intra-national actions as well as improve understanding of how the decisions have been reached and how they might be improved. Each case study concerned a conflict resolved between developing countries. In each instance one country held a stronger political

and economic position, and that country generally prevailed in the negotiations and in settling controversial aspects of treaties. Whether the agreements thus reached were mutually advantageous in the long run needs to be debated. In each instance it is safe to assume that new issues, or old issues receiving new attention, will have to be resolved at some time in the future.

The following conclusions are worth noting:

1. Scientific and technical information about the river resources, in terms of both short- and long-run availability, and the impact of development is needed in appropriate and timely fashion for decisionmakers within governments, thus enabling them to reach sound conclusions about the best method of developing the river.

2. The absence of "influencing agents," or their lack of interest, not only flaws the availability and use of information, but fails to provide a means of support for the governmental steps needed to implement or amend agreements.

3. Particularly in the case of the Itaipu development, the stronger nation tends to support principles of international river basin agreement as they had been adopted worldwide at its own convenience. Decisionmakers and influencing agents need to be aware of these principles if conflicts are to be successfully resolved.

4. Domestic conflicts between decisionmakers and potential constituencies that are resolved in the ordinary processes of government are useful in the development of knowledge about negotiations in the international arena.

5. Efforts by countries to reach agreement without either sound information or an attempt to inform constituencies about the questions that need resolution will probably, in the long run, create problems despite the apparent utility of quick resolution.

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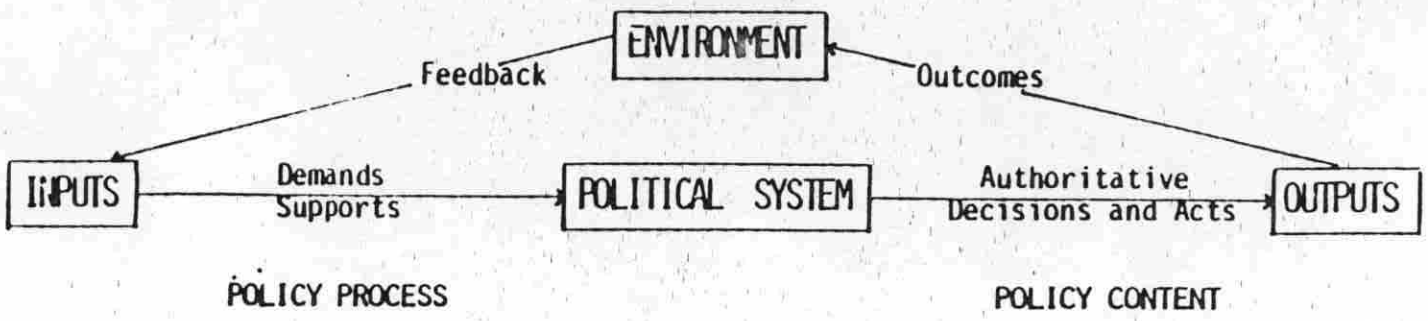

Figure 1. "Essentials of a Political System"; adapted from David Easton, A System Analysis of Political Life, New York, J. Wiley & Sons 1965.

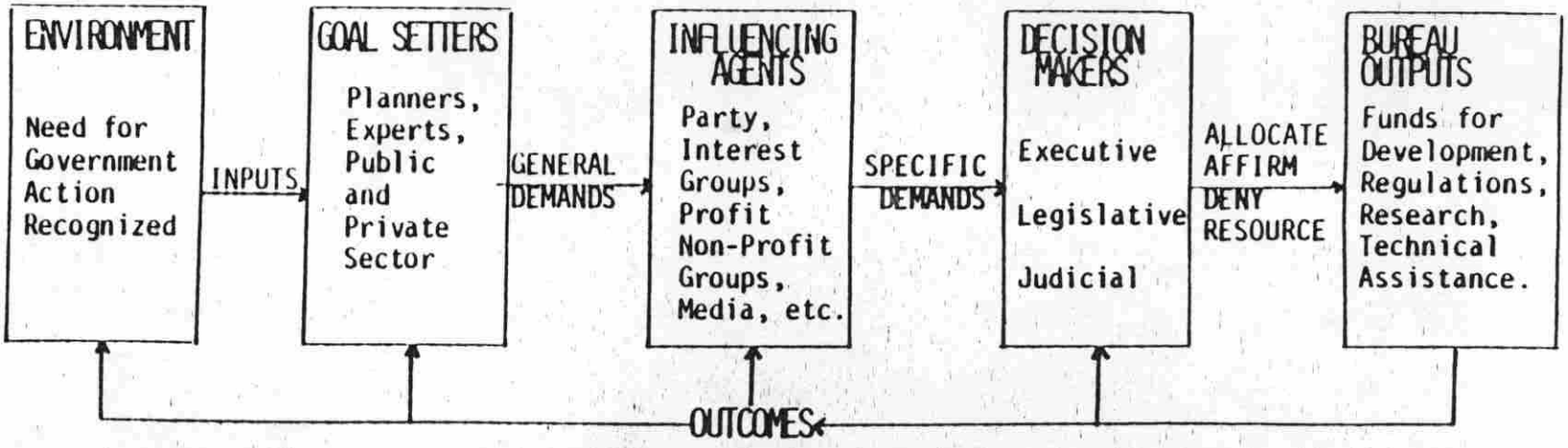

Figure 2. Policy Subsystem Model

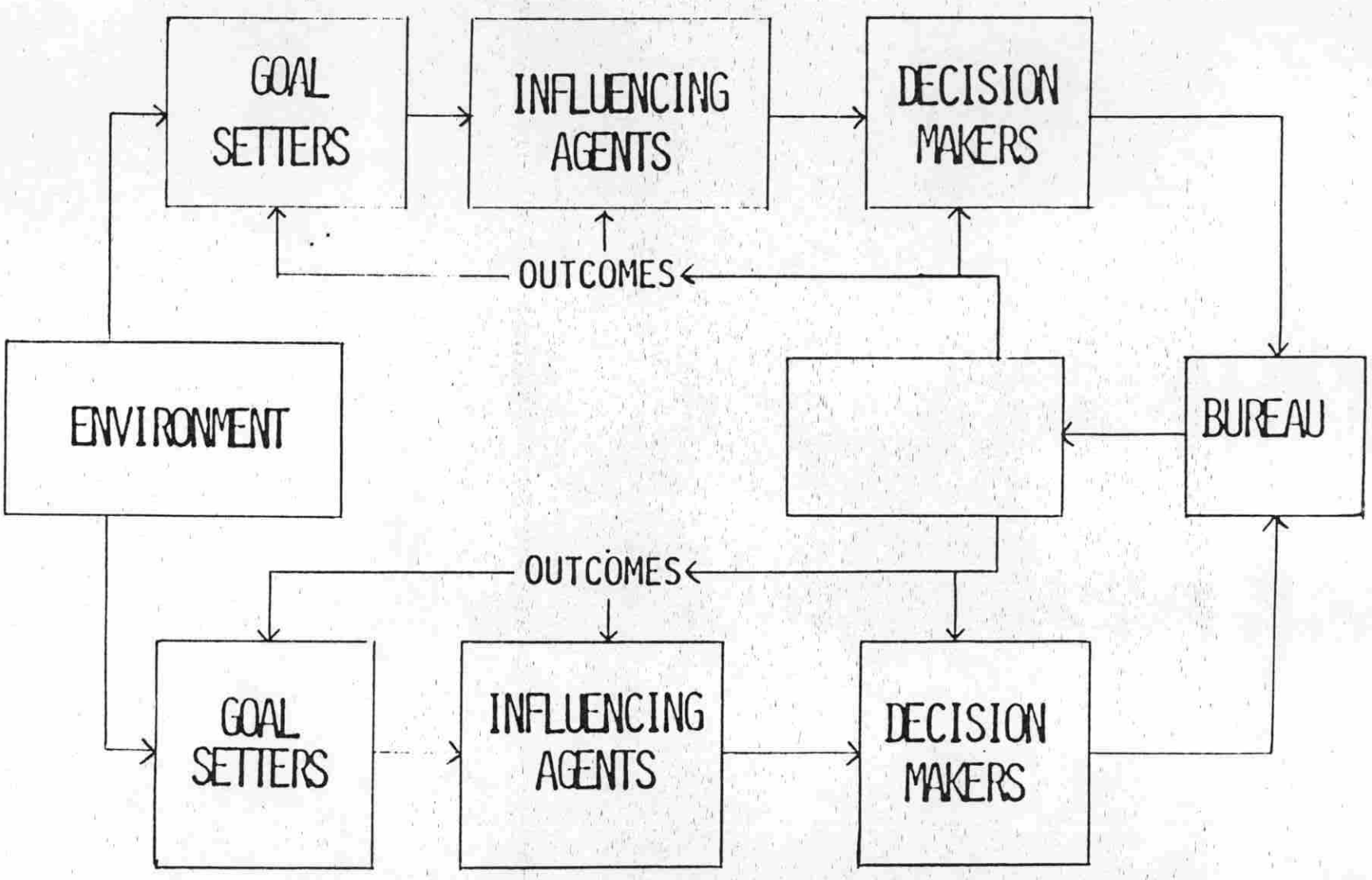

Figure 3. Model Applied to International Negotiations.

BRAZIL, PARAGUAY, AND THE PARANA

PERIOD-AGREEMENTS	Environment	Goals Set	Influencing Agents	Government Decisions	International Unit Established-Outputs
1962-1970 ACT OF IGUAZU 1966	Brazil Already developing hydropower in Parana River basin; need for more power recognized.	Brazil To build dam at Guaira site.	Brazil The military and economic sectors, and the executive.	Brazil Invades area in 1962; retires military occupation forces in 1967.	Joint Committee on Guaira Falls hydro potential established 1964; Paraguayan-Brazilian Technical Commission formed 1968.
	Paraguay Wants border at Guaira settled.	Paraguay To retain Guaira.	Paraguay The military and the executive.	Paraguay Rejects diplomatic note, but agrees to negotiations.	
1973-1984 ITAIPU TREATY 1973	Brazil Need for hydropower expansion increases with oil crisis.	Brazil To build the Itaipu Dam as fast as possible; retain control of inputs/outputs from construction/operation under guise of parity.	Brazil Economic sector and executive.	Brazil Abandons principle of prior consultation with co-riparian countries other than Paraguay to facilitate building of dam.	Council of Administration and Executive Directorship formed 1973; equal membership on both sides; allocates energy output; implements rules to set electricity price, royalties, and compensation. Both countries must present energy needs for next 20 years in 1983 - Paraguay does not comply
	Paraguay Due to depressed economy, dam jobs and outputs become impor-	Paraguay Economic development, especially from construction of dam.	Paraguay Executive; limited participation of economic sector; starting in 1973 criticism emerges from press and general economic sector.	Paraguay Decides to sign treaty with little technical, economic, and other domestic inputs; accepts inequitable terms; National Energy Commission formed 1980.	

EGYPT, THE SUDAN, AND THE NILE

AGREEMENTS	Environment	Goals Set	Influencing Agents	Government Decisions	International Unit Established
I. 1920-29 First Nile Agreement	Egypt As exporting country, experienced increased need for control of Nile for irrigation purposes.	Egypt Some data available over the centuries; economic data unreliable, but plans to continue water projects had to include agreement with upstream country.	Egypt Landowners and other financial interests supported expansion.	Egypt British High Commissioner and President of Egyptian Council of Ministers negotiated and made most decisions re control of Nile.	
	Sudan Any downstream diversion would have impact; Sudanese needs were actually less because of smaller population and more rainfall.	Sudan No reliable data from an independent source; lacked arguments to counter Egyptian affirmation of greater need; national water goals less clear.	Sudan Country lacked cohesion; under Anglo-Egyptian protectorate native presence of economic-social nature.	Sudan As protectorate of Britain and Egypt, decisions essentially made by governments of those countries.	None established; agreement specified settlement of differences through consultation.
II. 1950-59 Second Nile Agreement	Egypt Post-war expansion plus independence, growing nationalism, created need for much greater increase in control of Nile for longer crop growing time.	Egypt Goals for expansion of agricultural production needed at home and for export could only be satisfied with one large-scale water project.	Egypt Financial and land-owning elite had influence, but lacked effective participation in view of unsteady political situation; strong nationalism.	Egypt Decision to build Aswan High Dam followed takeover of government by Nasser in 1952; Russian funding speeded negotiations on Egyptian side.	Permanent Joint Technical Commission; equal membership on both sides; gathers data; determines water allocations; formulates policies toward other riparian countries.
	Sudan Economic development and nationalism also increasing but at slower pace; as upstream country had to seek protection from large-scale project; by 1951 believed had exhausted its allocation of Nile water.	Sudan Economic goals within country called for more water projects; favored smaller scale "Century Water Scheme." As upstream country needed protection from heavy flooding caused by Aswan High Dam.	Sudan Landowning interests exerted pressures for irrigation needs through Nile control.	Sudan Army coup in Sudan in 1958; resistance to Egyptian border incursion strengthened bargaining position; opposition to agreement rejected and negotiations finalized.	

BRAZIL, PARAGUAY, AND THE PARANA
(continuation)

PERIOD/ AGREEMENTS	Environment	Goals Set	Influencing Agents
1985-	Brazil Substantial numbers of Brazilians move to Paraguayan lands around the site; utilization of energy and water increases.	Brazil To increase economic opportunities, especially in agriculture, and increase political power in area surrounding dam.	Brazil Return to democratic rule (1984); more open participation expected.
			Renegotiation?
	Paraguay Local and displaced population in economic depression due to end of dam construction.	Paraguay Retain some of the promised but unfulfilled economic boon.	Paraguay Public, press, and other sectors critical of outputs from Itaipu; renegotiation urged, especially by industrial sector.