Theme: National Water Resource Plans

Case title: Progress towards the integration of water resources management in Brazil.

Brief summary
This case study describes Brazilian experience towards institutional development and reconciling interests of major water users (hydropower, agriculture and livestock production, domestic and industrial consumption, navigation) in the context of rapidly-growing urban populations, which usually have adequate infra-structure.

Brief description
The water resources of Brazil are generally plentiful but unevenly distributed. Water is essential to the economy for hydropower generation, agriculture (both rain-fed and irrigated), domestic and industrial consumption, and river navigation, and one of two main issues is to reconcile the demands of these sectors. Reconciliation is vital both for the nation's economy and the well-being of Brazilian society, and has been achieved by consensus. The second issue arises from the fact that Brazil's population is concentrated in rapidly-growing cities, often without adequate infra-structure for water supply, sanitary disposal, and protection against urban flooding and land-slides on steep slopes where there are irregular settlements. Pollution from both domestic and industrial waste, and from sediment and solid waste, is a serious problem in metropolitan areas. The approach has been to establish river basin committees, but there can be some conflict of interest between committees where rivers flow through several States. It was necessary to set up Legislation was passed to provide mechanisms for funding a National Water Agency - ANA which has worked well since its inception. However a serious problem at present is that government-imposed restrictions on public spending limit access to funds legally earmarked for water resources development and for training the professionals needed for IWRM.

Lessons learned
The main lesson learned from Brazilian experience is that the changes to water industry structure, and progress towards IWRM, have been achieved through non-partisan discussions between professionals, able to express views freely within a democracy that is approaching maturity.

Importance of case
The case of Brazil illustrates several aspects importnant for IWRM, namely: the need for unambiguous laws relating to water resource development and control; the need for strong and well-funded executive agencies capable of putting laws into practice; the need to charge for water as a public good; the need to involve other users, and the public at large, when decisions are taken; the need for basin-wide planning; the need to consult widely when decisions taken in upstream basins affect management of water resources in downstream areas.

Tools used:
A2.3 Reform of existing legislation
A3.2 Financing options I: grants and internal resources
A3.3 Financing options II: loans and equity
B1.3 National apex bodies

B1.4 River basin organisations
C5.3 Modelling in IWRM
C4.2 Communication With stakeholders

Keywords: *Legislation for water; establishing institutions; water charges; basin committees; conflict resolution by consensus.*

Main Text

Background & Problems

The water resources of Brazil are generally plentiful but unevenly distributed. Water is essential to the economy for hydropower generation, agriculture (both rain-fed and irrigated) and animal production, domestic and industrial consumption, river navigation, and eco-tourism, and one of three main issues is to reconcile the demands of these sectors. Reconciliation is vital both for the nation's economy and the well-being of Brazilian society, and progress achieved so far was initiated by means of consensus led by professionals. The second issue arises from the fact that Brazil's population is concentrated in rapidly-growing cities, often without adequate infra-structure for water supply, sanitary disposal, and protection against urban flooding and the land-slides that occur on steep slopes where there are irregular settlements. Pollution from both domestic and industrial waste, and from sediment and other solid waste, is a serious problem in metropolitan areas, and both surface- and ground-waters are affected. The third issue arises from natural climatic variability over the South American sub-continent, the causes of which are not yet well-understood so that prediction of changes to hydrological regimes are highly uncertain, but any lengthy reduction in surface-water availability would be disastrous in both economic and social terms. To deal with these three issues, the approach has been to establish

- An appropriate legal framework for water resources;
- A Secretariat for Water Resources with responsibility for defining water policy;
- A Federal agency with responsibility for putting policy into practice.

River basin committees have been established, but there can be some conflict of interest between committees where rivers flow through several States, since decisions taken by upstream committees can conflict with the aims of committees downstream. Progress has been slow but steady, and could well continue. However a serious problem arises at present because government-imposed restrictions on public spending limit access to funds, even when these have been legally earmarked for water resources development and for training the professionals needed for putting IWRM into effect. The main lessons learned from Brazilian experience are

- The changes to water industry structure, and progress towards IWRM, have been initiated achieved through non-partisan discussions between professionals, able to express views freely within a democracy that is approaching maturity.
- Progress towards improved good water management has been based on a sound legal framework, supplemented by an appropriately-funded executive agency.
- Basin committees have served the purpose of involving stake-holders in decision-making, but unless stake-holders perceive that decisions are executed, their interest will wane.
- Although the law may specify how funds are to be raised for IWRM, access to these funds may be restricted by governments wishing to exert control over public expenditure.

1 Problems confronting water resource management and development in Brazil

1.1. Institutional problems

An institutional overview of the urban environment must highlight the following institutional aspects: (a) land use and settlement control; (b) water supply and sanitation; (c) urban drainage; (d) solid waste; (e) the environment. Regarding land use, each Brazilian city was obliged to prepare an Urban Management Plan (Plano Diretor Urbano) under the Brazilian constitution of 1988. These Plans were limited to issues concerning roads, shade from buildings and a few environmental aspects, and many issues were omitted. The Plans usually aim at an understanding of where the city will grow, when they should be controlling and directing growth.

Absence of control over land-use and settlement

Prior to the 1980s, States were concerned about the contamination of basins where water was collected, and generally passed some sort of legislation on collecting basins. This law, which sought to preserve basins from population settlement so as to safeguard water sources, failed to take economic pressures into consideration. The law does not allow water-collecting basins (defined for each city) to be settled by people, and the owner of the land was obliged to pay tax on it. What then happened was civil disobedience, since an owner would simply abandon his land, which would be invaded by low-income families; sometimes an owner would himself organize the invasion, so that he could negotiate with the township council for a change of status for the land. The result was the worst possible, since clandestine settlements would occupy water catchment areas without any structure, causing contamination of the water. There was often no checks by the administration about what was happening. The main lesson to be learned is that imposing restrictions on land use without appropriate compensation leads to civil disobedience. In metropolitan areas there are some townships which cover a water catchment area. Generally townships that are in upstream areas of a river system or catchment area have no interest in exerting any rigid control because the impact occurs downstream of the city and beyond its jurisdiction. This scenario involves State or Federal intervention.

Water supply and sanitation

In the 1970s, sanitation companies (which are public) were created to deal with water supply and sanitation. These companies operate and can raise funds State-wide, which townships cannot. The 1988 constitution gave townships the powers to grant concessions for water services and drainage. Few Brazilian cities were functioning with municipal water services and the infra-structure was constructed by State enterprises. At the end of the 1990s privatisation of water and sanitation services was planned, as in other sectors of public administration. An impasse came about because State companies did not have service concessions in cities, which were operating without the legal basis for concession, whilst in other cities the concessions were about to lapse. Thus, the companies had no economic value to attract private capital. The government put before Congress a plan for a law to establish procedures to regularise certain elements of the Constitution. In this process, it was established that the State company could serve townships in metropolitan regions where there existed installations serving more than one township. It also sought to establish funding for the agency with responsibility to ensure that services gave value for money. However, this plan became involved in political discussions on the privatisation of State companies and was not approved by Congress.

The Federal government has, under discussion, a document concerning rules for the sanitation sector, but this has not been made public at present. It should be release to the public sometime in the first half of 2004. At present, there are many cities with privatised services, some of which function at township level but with the great majority on a State-wide basis. State companies serve about 82% of the population in terms of water supply and 77% in terms of wastewater drainage. These services are not regulated for their prices and quality of service provided. All evaluation is undertaken by the companies themselves. The Ministry of Health established standards of quality for river water and created the national agency for sanitary monitoring (Agência Nacional de Vigilância Sanitária: ANVISA), but its capacity for regulation is still limited.

Services provided by sanitation companies at present are as follows: (a) about 92.4% of the country is covered for water supply; (b) losses of water in the distribution network are 39% on average. There are no funds available to reduce these losses, although there are funds to look for new sources of water and for construction, but since there is no fiscal control of services, costs are added to the price of water; (c) on average about 50.4% of the population has sanitary drainage, and 25.6% have waste-water treatment. The efficiency of treatment over time is very low, and there is no regulatory control of results of treatment. There are many networks which do not collect any wastewater, and many treatment stations are idle because townships have no legislation requiring proprietors to link their residences to the sanitary drainage system, so that they avoid extra charges for drainage. ANA (Agência Nacional de Águas) launched a programme in 2001, called PRODES, which gets to the point of the problem. This programme funds 50% of wastewater treatment works but only pays according to the efficiency of the system, for which it monitors the quantity of water treated and the level of treatment. For constructing the works, townships issue public bonds. To take part in the programme, a township must first obtain approval of the drainage basin committee. Up to 2002, 170 undertakings had been approved with a total value of R$ 1.15 billion (~ US $ 400 million) serving about 25.6 million people. However, with limited resources in 2002 the Agency only invested R $ 17 million of a total value for the undertakings of R$ 66 million (~ US $ 22 million), which is about 6% of the demand (ANA, 2003b). In 2003 the programme suffered still further from the lack of budgetary resources and it is now under evaluation by the government.

1.2. Non-institutional problems

Until the 1980s, the separate sectors concerned with water use – principally the energy and agricultural sectors – had recognised that problems related to water quantity and quality were increasing, but solutions to such problems had largely been sought within each sector separately. During the 1980s, however, it came to be realised that such problems had a wider dimension and required a broader view, but that no adequate legal or institutional framework existed for their solution. It is perhaps no coincidence that the Brazilian Association for Water Resources (Associação Brasileira de Recursos Hídricos: ABRH) held its first national congress in 1979, bringing together professional engineers and others for the first of a long series of biennial meetings, at which the multi-dimensional aspects of water problems began to be discussed and formal conclusions issued. Thus the early meetings of ABRH provided the motor for change. The following are the problems identified as requiring solutions that needed to use an approach that cut across individual sectors.

Brazil is highly dependent upon hydropower to meet national energy requirements.

Over 80% of Brazil's energy comes from hydropower, and the country has 10% of the world's hydropower resources. At present the country needs investment of about US$ 3 to 5 billion annually, to meet demands that are growing by 2 to 4 %. Since the 1980s, risk of failure has increased as increases in supply have not kept pace with increasing demand. Power rationing occurred in 2001 but could have occurred sooner. However, from about 1970 onwards rivers flows have been higher (by up to 30% in some cases) than previously because of climatic variability, and this has, by good fortune, resulted in higher energy outputs. This increase in flow occurred mainly in the River Paraná basin where much of Brazil's energy is generated. In 2001, rationing brought about a marked reduction in demand for energy (of about 15 to 20%) which has become almost permanent; even in regions where there was no rationing, a reduction in demand of about 7 to 10% was observed. Economic growth and increases in demand are occurring from this plateau level, but the increase in new generating plant is not keeping pace with the trend.

Quality and quantity of river flows have been modified by land-use change to intensive agriculture and animal production.

Extensive areas of natural forest have been cleared in central and southern Brazil for the purpose of planting soya, whilst around the periphery of the Amazon basin (Rondonia and Pará) forest has been cleared for pasture and cattle production. River flows following forest clearance tend to be less regulated (sharper peak flows, more rapid recessions), whilst soil cultivations associated with annual crops have led to increased sediment transport, sedimentation of reservoirs, and in some cases serious gully formation. In some regions

of Brazil, erosion and soil degradation are serious; in the River Paraguay basin, cattle and soya production have produced important alterations in the production of sediment discharged into the Pantanal, principally in the area of the River Taquari. In areas where rice is grown on flood irrigation, heavy consumption of water has led to conflict between the agricultural sector and other users. Agriculture is also a source of diffuse pollution from fertilisers and insecticides. In the State of Santa Catarina, intensive pig- and chicken-production is increasingly becoming a cause of water pollution.

Consequences of rapid and uncontrolled urban growth

The urban population of Brazil is about 83% of the total, and is concentrated in the large conurbations of Brazilian State capital cities. These metropolitan regions (MRs) have a main nucleus and a number of surrounding cities. Rates of growth in the MR nuclei are relatively small, while rates of growth in the surrounding cities are very high. This high growth-rate is also found in cities which are regional poles of development. Cities of more than 1 million people grow at a mean rate of 0.9% annually, while the national statistics show that regional centres with between 100 and 500 thousand grow at annual rates of 4.8%. These rates of expansion cause severe problems. Because of inadequate legislation, irregular urban expansion often occurs in areas reserved for water catchment purposes, threatening the quality of city water supplies; and as population increases and becomes concentrated in urban areas, untreated effluents are discharged into rivers, with serious consequences for human health through water-borne diseases. Another problem arising is that the impermeability of large urban areas, and the canalization of streams running through them, is a principal cause of urban flooding which affects many Brazilian cities. In January 2004, more than 80 people died in Brazil, drowned in floods or buried under land-slides from hill-slopes.

All these problems result from the lack of any integrated management for urban land occupation and for urban water. The consequences of shortcomings in management are seen in the following: (a) contamination of water by irregular occupation and lack of wastewater treatment. This is brought about by unclear legislation and by a lack of management by the townships; (b) the water services in Brazilian cities have chronic problems, with losses of water during distribution and lack of rational water use at both domestic and industrial levels. When there is water shortage, the tendency is to look for new sources of water, without reducing losses and without developing new practice for rational water use; (c) there are high loads of untreated domestic and industrial effluent and of polluted storm-water discharged into rivers, together with solid rubbish and eroded material, exacerbated by increased urban flooding as shown in data from Belo Horizonte (Fig.1).

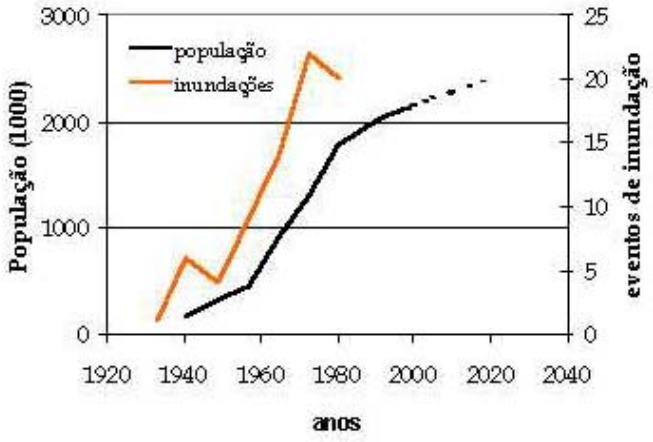

Figure 1: Urban growth and occurrence of floods in Belo Horizonte (adapted from Ramos, 1998).

Extreme hydrological events: floods and droughts.

About 10% of Brazil's land surface is semi-arid. Droughts, principally in the Brazilian North-East, are a common occurrence. Specific programmes exist and some actions have been taken in isolation, but there is no regional preventive programme to minimise drought impacts on the population as a whole. The semi-arid region faces the great challenge of sustaining its human population under very difficult conditions, where evapo-transpiration can reach 3500 mm with rainfall about 250 to 600 mm. States such as Ceará have 60% of their land derived from crystalline formations where aquifers are practically non-existent. In many regions, such as the "sertão" in the State of Pernambuco, water in the sub-soil is saline and cannot be used without desalination. The semi-arid region needs a volume of water sufficient to ensure availability of water in critical years, but when the residence-time of water in reservoirs is high (volume very large relative to size of inflow), the turnover in volume is small and salination occurs.

The problem of urban flooding has been mentioned above, but severe and prolonged floods can also occur in rural areas, notably in agricultural areas of the Rivers Paraná and Uruguay basins. Here forest clearance, and the consequent reduction in evaporation of water previously intercepted by the tall vegetation, seems to have contributed to increased runoff, whilst in the absence of the damping effect that forests provide, peak flows from intense rainfall become more accentuated. Smaller cities on the rivers can suffer severely from prolonged flooding, which also causes loss of agricultural crops and livestock.

Navigation to transport produce from increased land development

At present navigation in the interior is limited, being concentrated in the River Tietê, in the Taquari-Jacuí and Lagoa dos Patos in the south, and in the River Amazon. The greatest problems are related to the investment needed to maintain routes, and the logistics of transport systems. The growth in Brazilian agricultural production, which has passed 100 million tons of grain (the forecast is 132 million tons of grain in 2004, or 8% of world production) requires more efficient means of transport. At present, produce is transported by road, and known to be of low economic efficiency relative to rail and water. A greater transport of grain by river is found in Amazonas (River Madeira) where the grain produced in Mato Grosso (one of the highest producers of grain in the country) emerges into the North Atlantic, and thence to centres of processing and consumption in the northern hemisphere.

2. Description of Actions Taken

2.1 Institutional development

An important source of information on support for sustainable development are the documents issued under Agenda 21 Brasileira, created with the objective of drawing up a national strategy for sustainable development, by means of dialogue between government and society. This process is being developed by the Commission for Sustainable Development Policy and Agenda 21 (CPDS). Selected themes that reflect the Brazilian reality are as follows: *Sustainable agriculture; Sustainable cities; Infra-structure and Regional Integration; Management of Natural Resources; Science and Technology for Sustainable Development; Reduction of Social Inequalities.* Documents on these themes can be found on the site www.agenda21.org.br. In addition to these thematic papers, regional syntheses of related events also exist. Novaes (2000) has evaluated the regional and thematic papers, and has summarised their principal aspects. The following section gives the main points from these papers that refer to water resources, giving an overview of what has occurred in most recent years.

In the second half of the 1980s, there were growing concerns about the consequences for the environment of population and industrial growth, and there was increasing discussion about the need for integrated water resource management within the country. The activities of ABRH have been mentioned above; it gave a forum for discussion in technical terms, without any political component which might impede

its evolution and consolidation. The ABRH set out the elements for consensus in its letters from Salvador in 1987 (dealing with multiple uses, decentralisation, national system for water resource management, improved legislation, development of technology and human resources, information systems and national policy for water resources) and from Foz de Iguaçu in 1989 (dealing with national policy for water resources, national management system, legislation, technology and human resources, and information systems). All the principles approved in Dublin were present in these documents.

In 1990 the sector successfully pressed for legislation which came to be the basis for sector funding. The law concerning financial compensation for flooding of productive agricultural land, destined for reservoir construction, withheld 6% of the value of energy produced by an installation to compensate the State and townships, but a part of this resource was earmarked for hydrological data collection, science and technology, and hydrological studies. Nevertheless, the destination of these resources is the energy sector, which guarantees the hydrological data base in permanent form. This is the first great success, since independently of any other funds, resources are guaranteed by law for the collection of data and basic studies.

In this period, some forces had more weight than others in negotiations about legislation: The energy sector, which through its organisation and resources, always dominated water resource development; the environment interests countered with their assessment of potential impacts, and wished to participate in management processes; because of the circumstances of the time, there was a Ministry for Irrigation, which carried significant weight in discussion. The water-supply and sanitation sector was distant from the process, principally because it acted more at State level, when the focus of discussion was at Federal level.

With the reforms in the 1990s, a Secretariat for Water Resources (Secretaria de Recursos Hídricos: SRH) was created in 1995. Working together with Congress, it was possible to draw up a law which contained the principal technical elements of what had been discussed, although some points of conflict remained. In 1997, the law on water resources was finally approved after lengthy negotiation amongst the sectors involved. Having approved the legislation, the next step was to was to put it into practice. Within government, a second reform was being drawn up, leading to the creation of agencies for the control of sector development, once the ministries had defined their policies. This agency of control was the National Water Agency ANA (Agência Nacional de Águas), created on 17 July 2000. The main responsibilities of ANA include: granting concessions for water use in Federal rivers; flood and drought prevention; accounting for water use in Federal rivers; stimulating creation of committees for drainage basin management. As regards hydropower, the National Agency for Electrical Energy (Agência Nacional de Energia Elétrica –ANEEL) works together with ANA to ensure that reserves defined for energy production are maintained.With the creation of ANA, the law concerning compensation for flooded land was changed to provide funds for the sector, with ANA receiving 6.75% of the value of energy generated. Science and Technology applied to water resources received 3.67 % of the compensation funds. These are considerable sums for a sector which, before the passing of legislation, had been funded by budget oddments.

It can be said that the construction of the first phase (here termed Phase I) of institutional development of Brazil's water resources is now concluded. In it, legal elements have been established at Federal level for management, and institutions for governance have been set up. At State level, almost all States have passed legislation, and some have set up agencies for development, although at present these are rather few in number.

In this decade of the 1990s, committees and agencies for Federal and State basins were also set up, with different degrees of success. Most basins have just a committee, which has limited activity. In the sector of Science and Technology, there has been considerably increased investment in research which focuses on the problems and has permanent resources.

3 Outcomes

3.1 *Problems encountered during the implementation phase*

The precise definition of a drainage basin

One problem encountered has concerned the definition of a drainage basin. The Federal Constitution of 1988 defines a river in the Federal domain as any river which flows through more than one State or which possesses an international reach. But the law 9.433 defines the entire drainage basin as the appropriate planning unit. This has generated different interpretations in the case of basins in which the river's headwaters are within a State, but reaches downstream lie within Federal responsibility. Conflicts can arise, for example, where (a) a river whose entire channel lies within one State (up to the section of interest) but which has part of the area drained by it lying in one or more other States; (b) a river flows through one State, with its drainage basin lying wholly inside it, whilst being a tributary of a Federal river. This lack of clarity can lead to cases that have to be resolved by the courts. Taking the constitution and water law together, only those rivers which rise in one State and flow through it to the sea are under State control, whilst all others are under Union control. In practice, ANA has drawn up agreements with the States to set up a basin committee and State management for each sub-basin of a Federal river that lies wholly within one State. However, conflicts exist over the extent of environmental responsibility within this context, principally in the case (a) above. Environmental responsibility is related to the area influenced by the undertaking, which can often be interpreted in different ways. If the area of influence extends over more than one State, the environment affected by a licence becomes a matter of Federal concern.

Imposition of public spending constraints that limit access to earmarked funds

It was mentioned above that ANA (and CTHidro: see below) has being funded at present through legislation on financial compensation for areas flooded by hydropower reservoirs, and by a levy on the energy produced. Eventually, as the practice of charging for water becomes more widely adopted, funds will also be available from this source. Thus the sector should, in principle, be driven by these funding sources. Unfortunately, in Brazil not all allocated funds are necessarily available for use. The Federal Treasury takes its portion, and what is left varies year to year. Furthermore, because of national budgetary considerations, the government puts constraints on spending. Thus the portion effectively available can be about 50% of the value theoretically available. The good news is that the water resources sector has a permanent source of funding, and the bad news is that even though funds are specified by law, they are not available for use because of government devices for the control of public expenditure that cover all funding. There is therefore the risk that government intervention could destroy the will to improve the way in which water resources are managed. It is doubtful whether the situation can improve whilst Brazil's national finances are under pressure.

The function of basin committees

In cases where a basin committee exists without any associated supporting agency or funds to develop its activities, the effectiveness of the committee is very small. This discourages the participation of members who see no evolution in the process of management. The committee then functions as a talking-shop: a place for discussion which does not lead to action and results. Efforts to set up effective agencies capable of putting committee decisions into effect is therefore a high priority.

Difficulty in ensuring that water-industry sectors dovetail with each other

In terms of the natural environment, a present difficulty is that the process of implementing uses of water passes through various Federal bodies with different responsibilities, and this makes the process particularly complex in the case of hydropower installations. The Nacional Agency for Electrical Energy ANEEL (Agência Nacional de Energia Elétrica) issues development grants without environmental licence, so that when an undertaker is given the ANEEL licence there is no guarantee that water can be used since environmental aspects have not been considered. This process is totally contrary to the idea of sustainable development, since projects do not incorporate any environmental component in studies of alternatives. New procedures have been discussed within the ambit of Federal entities, and could be implemented in future, to give a single ticket of entry for projects. This process is now being discussed within government and a ruling on the subject should be produced soon.

Inertia limiting effectiveness of research needed in the water resources sector

In 2001 an agency called CTHidro was created as the source to distribute funds for investment in science and technology within the water resources sector. The focus of investment was in the sense of developing knowledge to solve problems identified within the country, with a management committee defining priorities and inviting researchers to develop research according to published themes. This type of investment seeks to avoid the fragmentation of research resources, although a part of these resources are kept for spontaneously-arising projects. Investments began in September 2001, with envisaged funding of about R$ 28 million per annum, but in effect R$ 40 million have been distributed in the two years, because of constraints on public spending. In these investments, some researchers have shown an inertia and reluctance to change direction from their past activities. It has been found that groups that have worked together over a number of years do not wish to be subjected to the kind of orientation envisaged by CTHidro, and press for resources to continue working along their former lines. There has also been a reluctance to look outwards by collaborating with researchers in areas beyond their own field of interest. Thus there is a need for a more integrated vision of the development of research in the water resources sector. These problems persist and could damage the quality of investment in research, if such groups are allowed to lobby strongly within the decision-making process.

3.2. Results, both expected and unexpected

Data availability

The network for collecting Federal data is substantial and the data are available on the internet without charge. This is an important advance, considering that in many countries of the region obtaining data is almost an impossible task. Nevertheless the system needs to be updated with respect to the following: (a) the data bank does not receive data collected over intervals of less than one day, which means that an important part of the information is not available and there is a rsik that this information will gradually be lost; (b) the national network only monitors basins of medium size or larger (> 500 km^2), with rare exceptions. This constrains the management of smaller basins. As the States generally do no monitoring, the country encounters problems in the management of water uses typical of smaller basins, such as water supply, irrigation of small areas, environmental conservation and flooding; (c) there is a fairly large shortage in the collection and publication of data on monitoring sediment and water quality, areas where the information system is still at an early stage of development.

Development of public awareness

In general there is strong concern at the public level over the country's water resources, which scarcely existed in the past, and there are now frequent requests for information from sectors of the population. Various sectors have been receptive to the idea of charging for water, notably industry, although there is resistance from the agricultural sector. For example, in the State of Paraná legislation was only approved if there was no charge for agricultural use.

Popular distrust about the continuity of funding

There is much popular distrust concerning charges and the way in which the monies levied will be used, since recent experience with taxes approved for one purpose and then diverted to some other use, is very common in Brazil. If funds ear-marked for use within the water industry become diverted and/or withheld, the growing positive attitudes towards charging for water could give way to cynicism.

3. Lessons learned and replicability

Public participation and democracy

In developing countries like Brazil, the development of appropriate institution (in the area of water resources) is enormously important. Having only emerged from autocratic rule only in 1985, less than 20 years ago, democratic processes are relatively new (and have been adopted with enormous enthusiasm), so that the country itself has passed through periods of political change during the building of democracy and the structure of the state. Thus the development of democracy went hand in hand with the beginnings of discussion on water resource management. Therefore, the first lesson to be drawn is that development of the legal and institutional regime needed for water resource management followed the development of democracy which allowed wide public participation. It cannot be concluded that integrated water resource management would be impossible in a less democratic environment, but democracy has certainly helped in the case of Brazil.

The importance of multi-disciplinary discussions between dedicated water professionals as a trigger for action

Brazil's process towards IWRM evolved within a technical framework, without political pressures in the forums for discussion. The ABRH was an important forum because it is an association of professionals who adopted important ethical principles such as: not to grant privileges to any sector; to approve public letters by consensus; to create forums for discussion when no consensus existed; to avoid politicisation and to maintain independence.

The importance of a sound institutional basis

Economic sustainability of the sector has been established through legislation giving a guaranteed budget for: the information system, governability, and funding for relevant science and technology. However, even with funding guaranteed by law, getting access to funds to their full amount is a serious problem which could compromise the entire system, and ways must be found to liberate funds from these restrictions. The legislation must be based on principles that include the need for decentralisation, for placing an economic value for water, and the integrated use of water resources. The combined construction of basin committee, agency, and economic mechanism for sustainability is essential.

The need for patience and tolerance

Perhaps the most important lesson of all is that the process of moving towards IWRM is slow and gradual, and that it is difficult to speed it up. But building it piece by piece is important for its consolidation within society, to educate society about the problem, and to solve it in an integrated manner. Tolerance is needed because a wide spectrum of interests, some of which are conflicting, must be reconciled during negotiations.

4. Links to further information

http://www.ana.gov.br (Agência Nacional de Águas)
http://www.aneel.gov.br (Agência Nacional de Energia Elétrica)
http://www.abrh.org.br (Associação Brasileira de Recursos Hídricos)
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Organisations and people

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