

River Basin Development Planning and Management: A Critical Review

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Summary. — River basins have been used for development planning and management since the 1930s. Various forms of river basin development planning and management have been applied in many countries. Unfortunately, the results have often been disappointing. This paper critically reviews river basin development planning and management to assess why problems occur, and then focuses on possibilities for improvements. © 1998 Elsevier Science Ltd. All rights reserved

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1. INTRODUCTION

Most of the world's land surface, apart from the most arid and cold areas, is divisible into river basins (Dasmann *et al.*, 1973; Saha and Barrow, 1981; Laconte and Haimes, 1992; Doornkamp, 1985, p. 31; Lundqvist *et al.*, 1985; Newson, 1988, 1992, pp. 88-187). Chitale (1992), drawing upon Indian experience, recognized "large"—over 20,000 km²; "medium"—2,000 to 20,000 km²; and "small"—less than 2,000 km² basins. If too large for planning and management, basins can be divided into sections using hydrological and catchment characteristics (e.g., upper, middle and lower basin) or subbasins by tributaries. The boundary¹ is normally distinct, easily mapped, and stable, and seldom is there a gap between adjacent basins.

Although there are some processes or activities that cross the boundary, basins are biogeophysical units with a high degree of functional integrity, and are relatively homogeneous systems, even when upper, middle and lower sections have different conditions and human activities. Each basin is unique, but there is enough commonality of hydrological, geomorphological and ecological characteristics for them to serve as widely applicable, non-ephemeral, operational landscape units for planning and management, and for maintaining environmental quality and pursuit of sustainable development (White, 1963; ECE, 1971; O'Sullivan, 1979; Pantulu, 1981; Reynolds, 1985; Ayoade, 1988, p. 166; Tundisi and Straskraba, 1995; Biswas, 1997).

If sustainable integrated area development is a goal, it is more likely to be achieved working with

coherent regions such as river basins (Alger, 1982; Sale, 1985). Interest has been renewed in part by the 1992 Dublin Conference on Water and the Environment and the 1992 UN Conference on Environment and Development, both of which called for comprehensive management of resources, using the river basin as the focus.

Basin uses need to be coordinated to avoid problems, and it is a logical step from this to using water resources development as an "integrating theme" and "development tool" for improving social, economic and environmental conditions throughout the basin (Kraenzel, 1957; Wengert, 1981; Dovers and Day, 1988; Kirby and White, 1994). River basin development planning and management (RBDPM) encompasses activities which, although within the drainage basin, can be distant from the river channels and may involve resources other than or in addition to riverwater. Whether national or international,² RBDPM involves three main activities: planning, management, and conflict resolution. It is much more than water resources development, seeking to integrate three interrelated, but separately evolved concepts: (a) multi-purpose development; (b) an integrative role for the drainage basin unit; (c) the acceptance of intervention to promote development (typically seen to be improvement of social welfare or regional conditions).

Various authors have tried to convey the spirit of RBDPM, for example: Downs *et al.* (1991, p. 306) suggested it meant "...working with a river and not

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against it"; Hufschmidt (1967, p. 324) noted ... "river basin planning is based upon the application of the scientific method and principles of welfare economics within a framework of public policy that can accommodate multiple objectives"; the UN (1970, p. 1), adopting a centralized and technocratic stance, urged that river basin development should be ... "the orderly marshalling of water resources of river basins...to promote human welfare." Satisfactory international RBDPM is an important challenge, failure to achieve cooperation and coordination may have more serious consequences than waste of resources and environmental degradation, it might threaten peace (Hillel, 1994).

Development planning and management can adopt a *watershed*, a *groundwater* or a *river basin* focus. The first concentrates on landuse and water movements from the moment of precipitation to the arrival in streams or groundwater (Pereira, 1973, Pereira, 1989). Careful watershed management is vital for good agriculture or forestry and to control soil degradation (Brochet, 1993; Cooper *et al.*, 1995), and can help stabilize streamflows, reduce the sediment load of streams, and improve groundwater recharge. Effective watershed management demands coordination of groundwater management, landuse and streamflow. Groundwater planning and management seeks to supervise and, if possible enhance, subterranean water, to do this effectively demands coordination with watershed and river basin activities. River basin development can involve streamflow modification by dams, barrages or channelization; intrabasin and interbasin transfers of water and must be coordinated with watershed and groundwater management. RBDPM supports integration of watershed, groundwater, land-use, river regulation, welfare improvement, healthcare, and most aspects of development.

2. ORIGINS AND TYPES OF RBDPM

Efforts to monitor and control rivers date back 5,000 years or more. The suggestion that a basin be used as a planning and administrative unit was probably first made in AD 1752 (Chorley, 1969, p. 20). The idea of coordinating the demands made within a basin was promoted by Sir William Wilcocks when he was planning to regulate the Nile in the 1890s. In British Colonial India, irrigation development led by the 19th century to Command Area Development Authorities, units administering areas supplied with water by a canal system, and in many respects similar to "top-down" forms of RBDPM (i.e. promoted by direct government intervention). RBDPM may also be promoted indirectly by providing funds and encouraging or assisting various nongovernmental organizations

(NGOs) or local development agencies to act. Sometimes development agencies have introduced RBDPM assisted by university staff or regional administrators (Rondinelli, 1981; Le Moigne *et al.*, 1994). RBDPM can be divided into the six forms:

(a) *Single purpose*

Early efforts were mainly single-purpose: flood control, hydroelectric generation, irrigation supply, etc. Planners and managers faced the need to share water between different users and to reduce conflicting demands. Development efforts are often still essentially "single purpose" (though those involved may claim otherwise). Simple subdivision of water does not deal with conflicting uses and misses opportunities for using water resources exploitation to get integrated development.

(b) *Dual purpose*

Combining two development goals can be done by making simple, easily monitored tradeoffs, for example, a dam can supply power and control floods. Nowadays, river development is seldom so simple.

(c) *Multipurpose*

Multipurpose RBDPM seeks to, more-or-less simultaneously, pursue a number of goals. In the past there was a tendency to simply divide up available water resources without assessing conflicts or what would be optimum development (UN, 1955).

(d) *Comprehensive*

The UN (1976, p. 25) defined comprehensive RBDPM as ... "a planned, complex, continuous and interdisciplinary process which is controlled on a systems analysis basis." It considers both land and water resources and development and how they interrelate, the goal being optimal development of resources (Thorpe, 1986). Comprehensive RBDPM puts less emphasis on promoting human welfare than integrated RBDPM.

(e) *Integrated*

There is some confusion in the literature between integrated and comprehensive RBDPM, reflecting the diversity of people interested in it.

Integrated and comprehensive approaches share: (i) adoption of a basin-wide program; (ii) multi-purpose development; (iii) a comprehensive regional development goal—some see comprehensive RBDPM as an improvement of the integrated approach with a welfare focus (for a review see Downs *et al.*, 1991, p. 302). In practice, it makes sense to use the term “integrated” for an approach which goes further than “comprehensive” RBDPM first, to actively use water as a “tool” for social and economic development (Falkenmark, 1985), or “engine of development” and, second, to deal with relationships between basin activities, demands, needs, etc. Out of the confusion the integrated approach emerges with a stronger intention of managing the river basin for human welfare.

RBDPM offers a framework for integrating water planning and management with environmental, social and economic development. Potentially it should support integration between planning, construction and operational management (and if need be decommissioning); between policies, program(s) and project(s); between national, regional and local; and between sectors and departments (Wiener, 1972; Le Marquand, 1989; Mitchell, 1989; Rowntree, 1990; Thanah and Biswas, 1990, p. 35). Scudder (1994, p. 102) described it as ... “the orderly marshalling of water resources of basins for multiple uses to promote human welfare.” Oyebande (in Kirby and White, 1994, p. 23) suggested it involved

...the solution of development problems which takes into account in a coordinated manner the interests of all sectors of the economy, branches of water management and social groups.

Integrated RBDPM has been promoted by a number of international agencies, e.g., the UN (1958), UN (1976) and the OAS (1978). There have been successful applications, e.g., the Volga, Dnepr and Rhône Rivers have a degree of integrated RBDPM (UN, 1970, p. 27). But, unfortunately, many efforts have been failures

(f) *Holistic*

There are arguments for RBDPM to adopt a holistic approach to improve its performance and support sustainable development (Risser, 1985; Gardiner, 1991; Anonymous, 1995). I am grateful to a reviewer for asking whether “holistic” is anything other than a new label succeeding multi-purpose, integrated or comprehensive, and whether all are simply reactions to the lack of RBDPM success? A holistic worldview has been maintained

by some philosophers, certain religions and branches of medicine from ancient times and is currently attracting many analysts, planners and managers. It can be said to be one of the foundation concepts of ecology (Smuts, 1926). There is no precise definition of “holistic,” but it might be argued that this approach seeks to understand chaotic complexity by studying *complete* systems, rather than adopting the usual reductionist stance focusing on component parts (for a critique see Phillips, 1976) (reductionist study should still be supported when appropriate—the West owes much to it). Two slogans are often quoted to explain holism: “everything is interconnected”; “the whole is greater than the sum of its parts.” A holistic approach has been advocated for: anthropology (e.g., Henderson and Netherly, 1993); global change response (e.g., Duraiappah, 1993); resource management (e.g., Savory, 1991); social science (e.g., King, 1992), and other disciplines. It should also be noted, that urban and regional planning have (largely forgotten) roots in an holistic, ecosystems approach (Slocombe, 1993, p. 290), and that sustainable development is essentially a holistic concept (Tacconi and Tisdell, 1993; Harvey *et al.*, 1995). Some RBDPM agencies used or use systems analysis (see OAS, 1978, pp. 80–88).

Holistic RBDPM tries to consider the entire basin system for the whole projected lifespan of development activities, and examines how components, people, planners and managers interact at all levels (Hennessy and Widgery, 1995). Mitchell (1989) argued the holistic approach should extend beyond integrated RBDPM to deal with strategic levels of planning and management. Newson (1988, p. 69) hoped that holistic RBDPM could ... “reform river basin management in the developing world...”

Existing administrative structures make a holistic approach difficult because they are organized sectorally and tend to be “stratified” with attempts at an overview seldom made below cabinet-level or equivalent. Specialists may be discouraged from adopting a holistic approach for fear they will be labeled “dilettante” or “generalist” (King, 1992, p. 60). A holistic approach requires care be taken (e.g., with EIA) that data gathering gives an on-going or regularly updated picture, not a misleading “snapshot.”

An RBDPM agency should be able to ensure an overview, while most of the staff involved do not have to venture too far from their specialisms. The International Commission on Irrigation and Drainage has been promoting holistic RBDPM and, in Australia, Queensland has launched a holistic Integrated Catchment Management initiative (Hennessy and Widgery, 1995).

3. RBDPM BODIES AND THEIR POWERS

Some argue that river basins should be administered by a single organization. This may be difficult, for nowadays, RBDPM is likely to involve multiple donors, NGOs, and participation by local people, so it must provide satisfactory coordination of diverse interests. RBDPM bodies vary in their goals (see Table 1), in jurisdiction and authority. Burchi (1985) recognized three basin/catchment/valley categories: (a) *authorities*; (b) *entities*; (c) *coordinating commissions* or *committees*. These broadly reflect autonomy, power and involvement in management and planning: *authorities* are more likely to have power to promote and enforce change; *entities* are intermediate and vary in power, and *commissions* or *committees* may have simply advisory or monitoring roles. The UN (1970) recognized RBDPM may be managed by: autonomous regional authorities; development corporations; planning executives; advisory bodies.

So, while most RBDPM bodies profess a management, planning and development role, some are little more than development corporations and many lack the power to carry through their

plans, it is therefore hardly surprising that results have been mixed. It is important that power should be granted with caution, for if a RBDPM body has too much and is unaccountable, mistakes and corruption are likely. It is also important to place the right people in power, as the following TVA case illustrates.

4. THE SPREAD OF RBDPM

(a) *A seminal experience: The Tennessee Valley Authority*

The US Tennessee Valley Authority (TVA) pioneered a shift from simple resource exploitation to that integrated, with other aspects of development, and directed at improving human welfare. Similar proposals had been made by the US Corps of Engineers in 1914 and the Niagara Frontier Planning Board in the 1920s, and in France integrated RBDPM was practiced by the Compagnie Nationale du Rhône from 1933, although it lacked basin-wide coverage. The TVA was established by the 1933 Tennessee Valley Authority

Table 1. *The goals of RBDPM*

The goals of RBDPM vary from one basin agency to another, but can include:

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- To coordinate the use of shared basins (multiusers/interstate/international).^a
 - To avoid environmental degradation.
 - To promote sustainable development.^b
 - To integrate land and water management.^c
 - To promote integrated, optimal development of natural resources, agriculture, infrastructure, social services, etc.^d
 - To provide comprehensive and decentralized management and planning.
 - To decentralise planning and management and make it adaptive.^e
 - To ensure developments within a basin do not interact in a negative way.
 - To focus natural resource benefits for regional development and serve as a regional planning and management strategy.^f
 - To attract development into a basin/remote area, countering the "pull" of large cities or favoured areas.^g
 - To promote rural development.^h
 - To provide an acceptable management and planning approach that might "side-step" existing stagnant or corrupt arrangements.
 - To establish a politically acceptable way of gaining the cooperation of co-riparian states or nations which would probably refuse to surrender authority to other types of agency.
 - To integrate environmental dimensions with other aspects of planning and management.ⁱ
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Sources and Notes:

^aPentland (1983); Tundisi and Straskraba (1995)

^bNewson (1992); Anonymous (1995)

^cFalkenmark (1981) Falkenmark (1985)

^dCooper *et al.* (1995)

^eHolling (1978, pp. 213–217)

^fKing (1965); Wengert (1981); Lundqvist *et al.* (1985); Mather (1989); Ebong (1988)

^gKraenzel (1957); Barkin and King (1970); Rondinelli (1978, 1980)

^hSalau (1986); Udofia (1988)

ⁱHufschmidt (1967); Dasmann *et al.* (1973, pp. 182–235). McHarg (1969) seeking to "design with nature" used the river basin as his "unit". In the 1970s the OAS (1978) experimented with environmentally-aware RBDPM. A number of environmental guidelines for RBDPM use have appeared (e.g., Interim Mekong Committee, 1982; Marchand and Toornstra, 1986).

Act, and has been hailed as the "...USA's first practical example of regional development" (Friedmann and Weaver, 1979, p. 67). It has been argued that the TVA enabled federal and state government to work effectively with public bodies and private developers in managing natural resources to guide and induce the development of a poor, backward region; a shift from America's established *laissez-faire* approach (Clapp, 1955). From its foundation until roughly 1936, the TVA made progress with basin-wide integrated development: controlling floods; generating and distributing electricity; improving navigation; stimulating industrialization and employment; extending education and welfare; countering soil erosion; reducing malaria, and considerably improving agricultural output (Finer, 1994; Lilienthal, 1944; Selznick, 1949; Martin, 1956; Morgan, 1974).

Following clashes between two of the three Board Members, A.E. Morgan and D. Lilienthal, emphasis shifted to "concrete" development goals, such as power supply, with "lower profile" given to welfare, and environment. So there was less progress from about 1936 with integrated development (Friedmann and Weaver, 1979, pp. 5; 172), and it became more of an electricity supply utility than RBDPM body. By the early 1980s the TVA region had a higher standard of living than areas surrounding it, but still below the US national average income, although there had been considerable expenditure focused on the basin (Street, 1981, p. 241). Chandler (1984) criticized the cost, the loss of some of the best farmland, drowned by reservoirs, and noted the flood control mainly benefited a single city.

There have been as many critics of the TVA as supporters, making objective assessment of achievements difficult (for a review see: Newson, 1992, pp. 96–98 and 246–247). It generated interest in RBDPM, but "copies" often had disappointing results and have been less numerous than might have been expected. The failure to replicate may have been due to WWII, colonial administrative practices that were still widespread until the 1960s, and a post-1945 shift in planning fashions to an "economic growth" focus, (Krutilla and Eckstein, 1958; McDonald and Kay, 1988, pp. 193–200). National RBDPM in developed countries focuses mainly on pollution control, water resources and environmental management, in developing countries integrated development is more likely to be the goal.

RBDPM entities in the United States and elsewhere between the 1940s and 1970s were often little more than advisory bodies or development corporations, for example, the Missouri Basin Inter-Agency Committee, or the Colorado Basin Commission (Kraenzel, 1957, pp. 227–235; Martin *et al.*, 1960; Missouri

Basin Inter-Agency Committee, 1969). "Successes" include the Fraser River Action Plan, initiated in 1991 to control pollution, improve environment and develop a sustainable integrated basin management programme (Pomeroy, 1995); and the Zuider Zee development (The Netherlands), which adopted a similar style of organization to the TVA (UN, 1970, p. 29).

(b) *The adoption of national (in-country) RBDPM by developing countries*

McDonald and Kay (1988, p. 198) sought to explain why RBDPM attracts developing country governments and aid agencies, but is less attractive to planners in the United States or Europe, noting it gave ... "a utopian picture of a responsive and paternal agency, fostering participation and grassroots democracy ..." Such utopianism is now unfashionable in developed countries, although a regional approach with local participation would be acceptable (Deknatel, 1986).

RBDPM is to some degree "established", Adams (1992, p. 117) observed that ... "river basin planning is an important part of the framework within which both African governments and aid agencies think about water resources". It has probably proved attractive because it is seen to support state control, structured planning and consideration of socio-economic issues during resource development. Adams (1992, p. 123) suggested that ... "gripped by the ideology of developmentalism, leopards are reluctant to change their spots." The "leopards" being governments, aid agencies and consultants that are familiar with RBDPM as a vehicle with which to address a wide range of development issues, and something that can be monitored as money is spent or time progresses.

After WWII RBDPM was tried in a number of countries, with an eye to promoting integrated area development, e.g., the Damodar Valley Corporation in India (established 1948), (Saha, 1979; Chitale, 1992); the Comissão do Vale do São Francisco (CVSF) of N.E. Brazil (established 1948); Colombia's Corporación Autónoma Regional del Cauca (established 1954); Sri Lanka's Gal Oya Development Board (established 1949); and the Helmand Valley Authority, Afghanistan (established 1953). In Sri Lanka, the Accelerated Mahaweli Programme (emerged in 1978 from the Mahaweli Project begun in 1969) has become one of the world's largest RBDPM efforts (Scudder, 1990). In the Philippines, RBDPM has been used as a route to rural and decentralized development, some of the impetus coming from US funding bodies (USAID) (Rondinelli, 1978, 1980, 1981; Koppel, 1987). In Mexico (King, 1965;

Barkin and King, 1970), and according to Adams (1992, p. 124), in Africa, government saw RBDPM as a way of side-stepping established administration that was "stagnant, corrupt or difficult."

The World Bank, OAS and UN have actively promoted RBDPM in Latin America (World Bank, 1992), where it has been applied to internationally-shared basins (e.g., Argentina, Chile, Bolivia; Brazil, Paraguay; the Amazon basin states) (OAS, 1978) (for a list of organizations see Lundqvist *et al.*, 1985, p. 193) and national basins (e.g. Brazil's Programa do Desenvolvimento do Araguaia-Tocantins-PRODIAT and CVSF, or the Cauca Valley, Colombia). There have been efforts to adapt RBDPM to Latin American needs, see: Lee (1995a), and Dourojeanni (1994).

The TVA was established under a federal democratic system, but RBDPM has been used in a wide range of political and social circumstances, including centralized non-democratic countries. Success does not seem to depend upon there being a particular political system, but may reflect management style, for example, Mexican experience (and the TVA) suggests effective RBDPM requires sound leadership. From the late 1940s to the 1970s a considerable portion of Mexico's regional development effort and expenditure was focused on integrated river basin commissions. These were intended to act as flexible tools of regional policy aimed in particular at decentralization in the face of metropolitan growth; results have been variable (Barkin and King, 1970, pp. 81-82).

Since the 1960s RBDPM has been widely applied in sub-Saharan Africa (Ross, 1982; Scudder, 1980; Godana, 1985; Ayoade, 1988; Mather, 1989; Perritt, 1989; Scudder, 1989a, 1989b, 1990; Fair, 1991; Hirji and Ortolano, 1991). Various agencies, notably the World Bank and the UNDP, have promoted RBDPM in Africa (Berthelot, 1989; Rangeley *et al.*, 1994), but Nigeria has probably made greatest use of it. Nigeria established River Basin Development Authorities in 1973 (Adams, 1985), however, results have been disappointing (Salau, 1986; Ebong, 1988; Kimmage and Adams, 1992). The blame, according to Udofia (1988, p. 407), lay with the operators. For example, the Niger Basin Authority has been criticized for establishing an over-large, centralized administration dominated by state ministers, and for excessive spending on buildings, administration and senior staff salaries (Scudder, 1990). Berthelot (1989) noted Nigeria's Lake Chad Basin Commission had a reputation for inefficiency in the 1980s. The Niger Basin Authority suffered withdrawal of USAID and Canada's CIDA funding after nearly two years of failure to achieve a dialogue with the Authority's Council, which had proposed to

spend about 30% of total funding on its headquarters. Mitchell (1995) observed that integrated RBDPM which had supposedly been adopted in Nigeria was not in practice followed.

Scudder (1989a, p. 144) commented that in Africa he could not

...recognize a single...body that had...played an effective role in planning and coordinating the development of a single river basin.

Starting 1985 USAID used Human Settlement and Natural Resource Systems Analysis Cooperative Agreement (SARSA) funds to support studies to assess the value of RBDPM in five African countries. SARSA used both local and US experts to assess the development achievements and role of RBDPM institutions (Perritt, 1989). The findings were that: RBDPM should continue in the future; integrated RBDPM had made little impact on the general population; there had been a failure to achieve potential at national, and even more, at regional and local levels; single purpose developments were common and had often generated negative effects (Smith, 1972).

Lee (1995a) felt that the early 1990s Mar del Plata Action Plan and the 1992 *Agenda 21* have helped renew *interest*, especially in its potential for supporting environmental management and sustainable development, but that there was little *enthusiasm* or agreement on national or international RBDPM (Lee, 1995b). World-wide, "RBDPM" often means large, single-purpose developments, especially dams for hydroelectricity, irrigation supply or flood control (Smith, 1972).

To summarize, national RBDPM is still attractive, but has yielded poor results, especially in achieving integrated area development, mainly because of faulty implementation and administration.

(c) *Internationally-shared basins*

Political and socioeconomic differences between co-riparian states make international RBDPM more challenging than national RBDPM. Much depends on the prevailing political atmosphere for effective conflict resolution, therefore, it might help if a UN body or the World Water Council adopted a strong intermediary and enforcement role.

According to the World Bank (1992, p. 156) 40% of the world population lives in shared basins. In 1993 there were over 280 international river basin bodies (Rogers, 1993). With demand for water generally rising and the possibility of global change altering precipitation, evaporation and transpiration rates, cooperation and coordination are vital to try to optimize development and counter

disputes. Conflict over shared water resources is felt by many (but not all, see Beaumont, 1994), to be a serious threat to peace. There is an expanding literature, some sensationalist, on water politics and basin-sharing (Mandel, 1992; Pearce, 1992; Rogers, 1993; Thomas and Howlett, 1993; Biswas, 1994; Shah, 1994).

The Jordan basin (Israel, Jordan, Lebanon, Palestine, Syria) has been studied by many, interested in the peace-keeping potential of a International Jordan River Joint Commission (Lowi, 1993; Hillel, 1994; Shuval, 1994). There has been a similar focus on the Nile, Egypt and the Sudan have a treaty dating from 1959, but other co-riparian states (Ethiopia, Kenya, Uganda, Zaire, Congo,) have not joined and demands upon the basin are likely to increase considerably (Gleick, 1994, p. 14; Okidi, 1991; Said, 1994). RBDPM has been applied to Tigris-Euphrates basin (Beaumont, 1978; Caponera, 1993; Biswas, 1994).

Indus basin RBDPM efforts to achieve peaceful, sustainable development have generated a large literature, as have the activities of Pakistan's federal Water and Power Development Authority (e.g. Mehta, 1988; Westcoat, 1991). The Ganges basin, home to over 500 million (ca. 10% of the world's population), has a history of India, Bangladesh and Nepal making and breaking agreements since the 1970s (Zaman *et al.*, 1983; Lundqvist *et al.*, 1985, p. 255; Chapman and Thompson, 1995).

Several countries have or plan interbasin transfers of water, and there are major multi-nation basin developments proposed or underway in South East Asia, South America, China and India. Notably, activities in the Mekong basin are set to increase but arrangements for the states involved are not yet satisfactory, although the Lower Mekong is coordinated by the UN Mekong Committee and Secretariat (1957-present: Cambodia, Laos, Thailand, Vietnam), (Lohmann, 1990; Anonymous, 1993; Hori, 1993; Jacobs, 1995, Jacobs, 1996).

For a review of international river basin organizations in subSaharan Africa see Godana (1985) or Rangeley *et al.* (1994). Mali, Mauritania and Senegal established the Organisation pour la Mise en Valeur du Fleuve Senegal (OMVS) in the late 1980s to promote integrated development and coordinate water resources use in the Senegal basin. By the early 1990s the OMVS had enjoyed only limited success (Quoc-Lan Nguyen, 1982; McDonald and Kay, 1988, pp. 206–211; Salem-Murdock and Horowitz, 1991; Scudder, 1994, p. 111; Venema and Schiller, 1995).

Europe has international basin agreements, notably for transboundary pollution control, covering the Rhine (France, Germany, Luxembourg, The Netherlands and Switzerland manage an International Commission for the Rhine, formed in

1950—Ruchay, 1995) and the Danube (Linnerooth, 1990; Rodda, 1994). According to Ayoade (1988), Europe had 48 international basin agreements in force by the late 1980s and European Union coordination is likely to expand this. Yet, in late 1997, Czech, German and Polish authorities were in conflict over poor coordination of flood controls for the Oder and Neisse rivers (*The Times*, July 22, 1997, p. 13).

There have been encouraging results with RBDPM between the United States and Canada, and the United States and Mexico (Cohen, 1982; Pentland, 1983). In Latin America, however, Argentina, Bolivia, Brazil, Paraguay and Uruguay may soon cooperate on the "Hidrovia" Project, but seem to be side-stepping RBDPM and environmental and social assessment. The Project seeks a 3,400 km-long, navigable waterway from the South Atlantic via the La Plata, Paraná and Paraguay to central Brazil, and then, possibly using the Amazon and Orinoco systems, to the Caribbean. Ultimately this project might link major river systems and could provoke serious physical and socioeconomic changes along its route and in the hinterlands served by the waterway. It would probably cause serious environmental impacts on one of the world's most important wetlands, the 200,000 km² Pantanal. Already there has been some channel-dredging of the lower Paraná and completion of new port facilities in Argentina (Bucher and Huszar, 1995; Heath, 1995). The danger is that the navigation development goal will dominate—fewer problems and more benefits are likely if effective RBDPM can be applied.

Discharges and escapes of pollutants to rivers are common, and an international basin approach is vital in addressing these transboundary issues (Linnerooth, 1990). Controlling pollution and sharing water requires rules, but international laws are inadequate. The International Law Association and the International Law Commission have tried to improve matters, developing the Helsinki Rules on the Use of the Waters of International Rivers (1966), the core of which is equitable sharing of water (Teclaff, 1996). These Rules help regulate international basin agreements but are principles rather than firm law (Pantulu, 1983; Zaman *et al.*, 1983). The Eighth World Congress on Water Resources (Cairo, 1994), urged delegates to establish a World Water Council as an umbrella body to help internationally-shared basin RBDPM reach common goals (Chitale, 1995).

The application of RBDPM to international basins seems to have had some success in reducing conflict, although there remains much more progress to be made, especially where co-riparians are a mix of powerful and less-powerful countries. The priority should be to develop a "continuity of organized

cooperation" (UN, 1970, p. 37), rather than seeking complex integrated area development too soon. The best vehicle is probably the permanent joint commission "policed" by a body such as a World Water Council.

5. WHAT HAVE BEEN THE PROBLEMS OF RBDPM?

RBDPM has been adopted under a wide range of political, economic, social and environmental circumstances. In addition, administration and policies often change, and corruption, bureaucracy, and debt present challenges. RBDPM must therefore be flexible and adaptive. Unfortunately, it has often been inflexible and over ambitious. To help counter these weaknesses the strategy of RBDPM should be progressive steps (Le Moigne *et al.*, 1994, p. 90).

Lack of baseline data and adequate monitoring hinders RBDPM. This may be due to scarcity of funds, trained personnel, institutional difficulties, or harsh environment (Mather, 1989). Studies suggest a need for better simulation modeling (Bayazit and Simsek, 1991; Lee and Wen, 1995; Venema and Schiller, 1995; Black *et al.*, 1996; Ward and Lynch, 1996) which requires good data. Another problem, partly related to a poor database, is that planning and management therefore are often based on false assumptions—there needs to be better supervision to counter this. Where data are a problem approaches should be flexible and adaptive (Holling, 1978).

Most researchers conclude that national RBDPM is worthwhile, and international RBDPM is vital, the problem is ensuring they work. Similar implementation difficulties occur with other, development approaches, for example: the "green revolution"; impact assessment; and sustainable development. The response to difficulties with these and RBDPM has broadly been to advocate: sensitive multidisciplinary study so the approach can be adapted to meet local or regional needs; flexible, adaptive approaches to cope with unforeseen problems; and community participation to try and ensure administrators are accountable and heed people's needs.

According to Tundisi and Straskraba (1995, p. 35), there are four important components of RBDPM which have to be satisfactory for it to succeed: (a) the *research system* (provision of data, monitoring and understanding of the basin structure and function and exploitation activities); (b) the *public sector* (there must be state and local agencies, or whatever bodies are needed to satisfactorily implement development); (c) the *involvement of the private sector* (crucial for joint ventures, funding, and exploiting resources); (d) *community participation* (local people

must be aware of what is happening and motivated to support it, or problems are likely). It has been rare for all of these components to reach a satisfactory standard in RBDPM, especially in developing countries.

A common complaint is that an RBDPM body has inadequate power to do more than advise. When granted adequate powers and financial autonomy there have sometimes been promising results, but at the risk of excessive bureaucracy and corruption. Another problem frequently encountered is that the RBDPM body is unable to control the whole basin. This may be because it does not have the jurisdiction, or because of inadequate funding for monitoring, or it may result from poor central government decision-making. If an RBDPM body fails to control the upper basin there can be problems of pollution or watershed misuse leading to mid- and lower-basin silting, erratic streamflows, etc. A RBDPM body may need to "tax" activities in one part of a basin to support development and problem management in another part, e.g., if more money is generated in lower- and mid-basin than the upper.

RBDPM can be difficult if it has to coordinate several co-riparian states, ministries or other bodies. For example, the Niger Basin Authority at one point involved nine countries, posing problems for monitoring, communicating and reaching agreement (this is especially problematic if there is no common language or there are social or ethnic groups in conflict—see Ross, 1982, p. 7). Bodies involved in RBDPM may be rivals, or secretive, and fail to share information. Communications difficulties can also develop between administrators and experts. RBDPM must be based on good communications and an ability to problem solve. International basin organizations especially need to ensure regular, frequent co-riparian exchanges of data and views.

Faniran (1981, p. 12), seeking to explain widespread failure to achieve successful integrated RBDPM, suggested one reason was that resources were controlled by a range of bodies and that coordinating this was sometimes too great a challenge. The reason he felt might be that sectoral planning and management was being applied to multisectoral development situations. Some funding agencies promote a sectoral, rather than a regional or basin focus, *let alone* a holistic approach (Scudder, 1994, p. 111).

If RBDPM is to offer integrated area development it requires a multidisciplinary or transdisciplinary approach to effectively coordinate a wide range of disciplines (Saha, 1981, p. 33; Gershon and Duckstein, 1983; Venema and Schiller, 1995).

When international or national RBDPM bodies are too centralized and hierarchical, it can become

difficult for them to work with NGOs and local institutions and they are slow to respond when faced by unexpected problems. Not only developing countries RBDPM fails in this way, the ruination of the Aral Sea (southern CIS) has been attributed to faulty centralized planning which focused on irrigation development without considering wider issues and failed to respond to obvious environmental difficulties (Kotlyakov, 1991; Levintanus, 1992).

Politics can determine who is employed, what is on the agenda, and how RBDPM proceeds. This is a problem in developed as well as developing countries—for example, in the case of the James Bay Scheme in Quebec, the intention to export power to the United States may have been influenced by a desire to increase the Province's economic base in preparation for possible independence (Scudder, 1994, p. 108). Sometimes political influence has seen to it that RBDPM boundaries match territorial limits rather than drainage basin divides. Adams (1985, p. 30) noted Nigeria's state and federal interests needed better coordination, and that without it, RBDPM had been a ...“facade of integrated planning...” (Adams, 1985, p. 301). Political interference may be indigenous, or from outside the basin-state(s), Smith (1972, p. 4) argued that the Aswan High Dam ...“was built for political reasons, not sound river basin management...[it was]...a result of political rivalry between the United States and the Soviet Union”. RBDPM has often been “highjacked” by government, hydro-electric, irrigation or public works department interests—and so has failed to be sufficiently integrated.

An important problem noted by Ross (1982, p. 7), in The Gambia and Senegal, was that some aid donors insisted on a bilateral relationship with the RBDPM authority (i.e. aid conditionality—“tied-aid”—given in return for recipient undertakings), and this loss of autonomy can mean that decision-making becomes unsatisfactory. A RBDPM body must monitor and revise implementation if need be, whether or not donor funding is involved. RBDPM is an effective way of dealing with multiple donors (Berthelot, 1989, p. 215; Scudder, 1994, p. 102).

Scudder (1994) accepted that RBDPM in sub-Saharan Africa had missed many opportunities, but felt it was still a relevant approach in the 1990s. Udofia (1988, p. 415) came to a similar conclusion, that faults lay with the operators, not RBDPM as a concept. RBDPM can be dominated by special interest groups promoting narrow-focus development, and sometimes engineers or economists control planning and management. Changing this may not be easy, but might be helped by more open and accountable planning and management. RBDPM has often supported resource exploitation for export or benefit of urban peoples, rather than the basin

inhabitants, yet the latter suffer the unwanted side-effects of “development.” Frequently there is a failure to consider the maintenance of environmental quality or to support existing economic activities of the local people: for example, those planning a large dam ignore or overlook *downstream* floodplain agriculture, traditional fishing or small-scale irrigation, even when they are practiced by a great many people (Bessis, 1982; Barrow, 1987). Consequently, the net benefits of RBDPM are reduced or become negative and sustainable development will be unlikely (Fair, 1991; Kimmage and Adams, 1992). A number of those who have reviewed river basin development have called for better integration of undervalued traditional agriculture or fishing. RBDPM bodies need to pay more attention to institution building, local involvement and empowerment, but it may be difficult when national planners and international consultants are involved (Scudder, 1980, p. 395). For some developments a way of obtaining training and achieving participation is through a policy of “build-operate-oversee-transfer.”

Before the late 1980s measures to protect against environmental and social impacts were widely seen as delays to development or “luxuries.” RBDPM increasingly seeks environmental management and sustainable development (e.g., for details of efforts in the Zambesi basin see: David, 1988), to do this requires adequate *basin-wide* environmental and social impact assessment (for RBDPM impact assessment and environmental guidelines see Interim Mekong Committee, 1982; Marchand and Toornstra, 1986). In practice, however, such measures tend to be watered-down or side-stepped (Hufschmidt, 1967; Lubin, 1977; Pantulu, 1983; Johansson, 1991). Unfortunately, some RBDPM bodies have resisted impact assessment and monitoring. For example, Hirji and Ortolano (1991) examined the case of the Tana and Athi Rivers Development Authority (Kenya), which tried to avoid donor-required EIA, and then ignored the measures demanded by Kenya's national Impact Management Policy. In this case, granting a RBDPM body sufficient autonomy and power to give it planning and management “teeth” also resulted in difficulty in applying impact and other controls, and even national legislation.

Large dam projects continue to generate problems, notably unsatisfactory resettlement and re-establishment of relocatee livelihoods, water-related diseases, and downstream impacts. These have been costly to governments and a source of considerable human misery, yet are still common in the late 1990s. For example, there are currently serious problems associated with the Three Gorges Dam in China and the Sardar Sarovar Dam in India. Impact assessment can just be a means for identifying

problems, or can be *integrated* with planning and management and help ensure public accountability and community involvement.

6. POSSIBLE IMPROVEMENTS TO RBDPM

Integrated RBDPM, integrated rural development, and integrated area development have a reputation for running into difficulties—largely because they are *complex strategies* (Koppel, 1987). It is difficult to overcome these problems of complexity and find a practical framework to better integrate environmental, socioeconomic and policy issues at a regional scale (Isard, 1972; Nijcamp, 1980; Briassoulis, 1986). After decades of efforts, Slocombe (1993, p. 290) noted there was still a need for

...a synthesis of ecosystem science and ecosystem approaches to provide a transdisciplinary framework that links biophysical and socioeconomic research and practice in a region or ecosystem through and holistic, ecological and participatory methodology.

Adams (1985, p. 305) suggested that, for Nigeria, the opportunity for RBDPM may have been lost, and that with modern conditions, it might make sense to move to a state-wide rather than basin approach. That is roughly the situation in the United Kingdom, where water resources planning and management are the responsibility of 10 regional Water Authorities (established in 1974 and reorganized in 1989 into Water Service Companies), regulated by a National Rivers Authority (House, 1991). The UN (1976) proposed RBDPM should seek national-level coordination plus regional/basin-level decentralized control (I would add international invigilation). In Sweden intermunicipal river basin bodies have been effective (Gustafsson, 1996).

The basin should offer a good systems and areal framework for developing a holistic resource management model (Savory, 1988). "Policing" should be undertaken by an independent body (or bodies) with enough authority to insist on improvements, e.g., a UN agency, a World Water Council, or a professional planning body. Community participation can help planners and managers glean information and ideas, ensure they are accountable for their actions, and inform the public (Le Moigne *et al.*, 1994, p. 47; Burton, 1995); Williams and Dee (1995) report successful inputs from *ad hoc* citizen groups in integrated water resource planning for the Santa Fe River (New Mexico).

Geographical information systems (GIS) should help in the gathering, sharing and processing of data (Goulter and Forrest, 1987), and there is potential for applying computer-aided decision-support techniques such as systems analysis. Expert systems can

help when there are insufficient trained staff (Jarman, 1992; Raj, 1995; Fedra and Jamieson, 1996; Jamieson and Fedra, 1996a, 1996b), and assessment tools like the Delphi technique, can assemble and give more equal weighting to the views of different experts when evaluating options (Le Moigne *et al.*, 1994, p. 45).

RBDPM must cope with conflicts between national and regional policy. The TVA ran into such problems, with critics claiming the basin benefited at the expense of all other US states. SARSA findings (Perritt, 1989, p. 207) suggest that more flexible integrated planning and management might be achieved if regional organizations (such as universities) and local people affected by development were involved. Faced by challenges similar to those of RBDPM when studying sustainable development, Tacconi and Tisdell (1993) proposed a "learning-by-doing" and "development facilitator" approach—applied to basins this could make planning and management more sensitive and adaptable.

RBDPM initiatives in the People's Republic of China, apparently quite successful, are based on a different approach to that adopted in the United States and most developing countries (Sun, 1994), being founded on local involvement, self-reliance and mutual cooperation, rather than central government intervention and funding (Faniran, 1981, p. 13). By backing local practices rather than large-scale activities RBDPM might achieve more positive regional development and sustainable development results. Perritt, assessing the value of RBDPM in Africa, felt it offered promise if it could better involve local people and stress multipurpose goals. By failing to do this RBDPM

...had not accomplished its potential as a tool for comprehensive development at the national and regional scale and had least affected local development (1989, p. 205).

Drawing on African experience Scudder (1994, p. 110) suggested RBDPM, while providing overall coordination, should be handled by more than one institution, not a single basin authority, to reduce bias and improve scrutiny of development activities. RBDPM must be compatible with the demands from a growing diversity of government institutions, funding bodies, NGOs and user groups. Given this increasing complexity, it is vital to avoid bias in monitoring, planning and management, the solution is probably to *coordinate* a range of state, federal, commercial and private NGO bodies.

Because multinational and transnational corporations often dominate bidding for development opportunities RBDPM bodies should explore ways

of controlling this and aiding the less-powerful to participate (in practice difficult because of political and economic forces). It is especially important to ensure traditional production systems are not overlooked when there is a temptation to initiate large-scale developments. Often these traditional systems are little researched, and more study is required to make it clear what they have to offer, how they might be vulnerable, and how they might be effectively upgraded. There must also be a shift in emphasis from crude resource exploitation to incorporate environmental management, sustainable and appropriate development goals. This demands better links between RBDPM and environmental planning (McHarg, 1969; Kliot, 1986).

RBDPM must cope with problems such as global change, urban growth, and transboundary pollution, and to do so effectively it must model likely future scenarios (Westcoat, 1991). It must become more adept at avoiding difficulties, rather than responding to problems when they materialize (and may be costly or impossible to cure). To do this it must better use impact assessment, eco-audit and environmental management systems. That demands better methods, better application of them, and satisfactory response to the findings.

Environmental and social impact assessment are developing better procedures for predicting indirect and cumulative impacts. There is promise in strategic environmental assessment (SEA), a form of EIA which adopts a tiered approach, designed to give local-to-national, even global coverage (Therivel and Partidario, 1996). SEA can consider policies, programs, and projects, not just adopt a single-project, or sectoral focus, and so could be a powerful "tool" for holistic RBDPM. There is also promise in integrated regional environmental assessment (Ballard *et al.*, 1982). Eco-audit and environmental management systems are increasingly being adopted by industry and government bodies to self-assess and voluntarily regulate their practices by developing management goals and plans which are examined by an independent standards authority, awarding EMAS,³ BS7750, ISO14001, or similar certification, if these are sound. The client organiza-

tion undertakes to regularly re-audit and publish reports. Eco-audits and environmental management systems might be applied to RBDPM as part of a regularly repeated review process to improve management quality and public accountability and to anticipate problems and needs.

Le Moigne *et al.* (1994) made three sets of suggestions for RBDPM improvement:

(a) for international basins:

- focus on well-defined objectives;
- ensure developments are mutually beneficial and desirable to all involved;
- ensure developments relate to and form part of a long-term integrated RBDPM plan.

(b) whether international or national, RBDPM administrators must be aware of:

- the resources available;
- demands made upon the basin;
- constraints;
- feasible options.

(c) RBDPM strategy formulation (for national or international basins) would be better if there were:

- established, accepted basic rules or laws;
- regulatory mechanisms and enforcement ("policing");
- trained staff;
- satisfactory organizational structures.

My suggestion is that RBDPM could be refocused to emphasize its coordination and oversight role; this should help ensure a transdisciplinary approach, experts could be employed without becoming "generalists" (tools such as the Delphi technique and expert systems could coordinate their inputs). To support a holistic and anticipatory approach, involve the public and order strategy, RBDPM could make use of SEA, eco-audit and environmental management systems, and regional environmental assessment. "Policing" by an independent body is important to reduce poor implementation and management. Oversight, management and planning would probably be better if more than one body forms the RBDPM authority (at least one a "policing" body, although governments might be unenthusiastic).

NOTES

1. "Watershed" is widely used to indicate the entire catchment area of a river or drainage basin, but in the United Kingdom it has been used to refer to the boundary or "divide" that delineates a basin.

2. "National" is used for basins not shared by more than one country. "International" or "shared" is used for basins where more than one country is involved in resource use.

3. EMAS—Environmental Management and Audit Scheme, the European Union's eco-auditing and management system, participation is voluntary, but the process is tightly regulated and monitored to ensure consistency (launched in 1993). BS7750 and ISO14001 are roughly similar to EMAS, managed by the British Standards Institution and the International Standards Organization respectively.

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