Thematic Reviews: Institutional and Governance Issues

River Basins Organisations in India – Institutional Frameworks and Management Options. A Case for Fundamental Review

Abstract

The increasing role and relevance of institutional structure to manage river basins is gaining prominence, due to failure of large scale centralised interventions in the river basins and with growing concern for community-based approach. The failures, largely guided by technocentric approach, have misunderstood the river systems and communities as being stable and that they are liable to be controlled for development.

What is clear from the origin, functions and constitution of RBOs in India is that they are all structured for planning, design and implementation of large projects. It is also clear that they do not even intend to be participation oriented or open bodies. Proper river basin organisation encompassing the needs, resources and priorities of whole river basin or even for majority part of river basin has not been done in case of a single river basin in India.

What is important is the emergence of various community-based initiatives that have been building on the community knowledge systems and evolving rational options for river basin development for integrated development, rather than technocentric approach. The paper calls for a 'threshold approach' in managing the river systems through RBOs. The approach is process-oriented and is context specific. The RBOs involved in managing the river systems should provide an 'enabling environment' for understanding the dynamic and complex river system through an 'interactive approach' to scale-up and scale-out participatory management. This requires the government institutions to restructure with a view to devolve powers to community institutions for evolving rational options for river basin development. Such institutions that are community-based should be 'learning organisations', that emerges gradually through debates and networking with different actors by devolving responsibilities to the local institutions, promote realistic options for basin development and provides a flexible framework for managing the complex and dynamic river basin system.

CONTENT

> *"Where such a vital matter as river basin development is concerned that affects all aspects of life and living beings, co-operation among different actors for management cannot be sterile or static concept."*

1. Introduction

At the end of twentieth century the increasing role and relevance of social and institutional structures in connection with the whole field of contemporary environmental management is gaining prominence. The essential thing is that river basin is appreciated as a region for comprehensive planning, where its relationship with the population have one form of common resource base. Consequently, river basin has been accepted as an ideal unit for comprehensive planning and management through an institutional structure that determines the effectiveness of the rational and informed decision-making and channel for effective popular participation.

The institutional structure for river basin management has been relevant in view of large dams centered water resources development in India. However, the RBOs in India lack in a perspective towards comprehensive understanding of the river systems to evolve rational options for resource management, fail to address the social and economic inequalities, fail to make a comprehensive impact assessment of the river projects to be a 'learning organisation' and to acknowledge the role of community knowledge in resource planning and management.

The paper focuses on river basin organisations in India. In the first section, the paper highlights the complex existence of the river systems. To overcome this complexity RBOs in India have evolved various technocentric approaches. However, these technocentric approaches have been largely guided with an engineering perspective, which has misunderstood the notion of comprehensive approach, and has several operational and institutional drawbacks. The paper calls for a 'threshold approach' in managing river basin, which is process-oriented, is context specific and the institution involved in the management provides an 'enabling environment' for devolving powers to the community and builds on the knowledge base of the community in evolving rational options for river basin development. Finally, the paper calls for a community-based approach for evolving RBOs that is a 'learning organisation', gradually emerging through debates and networking with different actors, promotes realistic options for basin development and has a flexible framework for managing the complex and dynamic river basin system.

2. River Basins and their Complexities

River basin is a 'geographical unit' enclosing an area drained by streams and channels that feed a river at a particular point. All the precipitation that falls on these slopes will either evaporate, used by plants and other living organisms, sink into the

ground or end up in the river after various natural and man-made uses. Thus, it follows that river basin provides an important region to understand the implication of any particular form of human use of water. Very often, river basin has been considered to be operating in a steady-state equilibrium and assumed that can therefore be managed by relatively control systems, like large dam and embankment projects.

However, this perception is fundamentally flawed. In fact, through large dams, among other impacts, the morphological and sediment transfer processes gets accelerated in one region, while the same gets hindered in another region. Activities that use water (like irrigation, municipal and industrial water supply) or change its quality (e.g. sewage and industrial discharges, pesticides runoff and others) or the pattern of its delivery further downstream (e.g. hydropower production, reservoir storage and releases) has implication for other possible uses downstream. It is important to note that logical implication of river basin as a unit for planning and managing water resources is that the smallest watershed is the unit for planning and management. This is also symbolised in "From the ridge to valley" principle accepted by India's rural development ministry in charge of watershed development. Another logical implication is that before all local options are explored and utilised in all upstream areas it would be irrational to decision to go in for large dams at any point in river basin. Unfortunately, the dam builders are yet to accept this.[1]

Thus, understanding the integration of these systems will make a sense for planning, management and in evolving a river basin organisation (RBO). It is important that any organisation, which is going to facilitate its planning and management must respect the fundamental physical integrity of the river systems and its relations with the socio-cultural aspects of the people in the basin.

3. River Basin Organisation & River Management in India.

It has been recognised by early proponents[2] in India that comprehensive management of river basin can be promoted through River Basin Organisation (RBO) (Chitale, 1992: 31). However, their idea was misconceived to control, conserve and utilise the river through large dam projects. The framers of the Constitution of Independent India made the entry of 'water' in the state list, recognising the difficulty to monitor and regulate by the Central government (CWC, 1997).

The independent India witnessed a new era, like in other third world countries. On the one hand, the country was poverty stricken and underdeveloped, and on the other hand, it was determined to restructure their economy through modern scientific and industrial development similar to the 'first' world. After independence in 1947, Nehruvian faith in modern technology led him to consider large dams as 'temples' of development and can be promoted through centralised management. This was

[1] Personal Communication from Mr. Himanshu Thakkar, Centre for Water Policy, New Delhi.

[2] One of the earlyproponents have been Dr.A. N. Khosla in 1945, when he was the Chairman of the Central Water Irrigation and Navigation Commission of the Government of India (now called as Central Water Commission).

supported by the so-called 'success' of the Tennessee Valley Authority (TVA) in United States of America. The TVA engineers were invited to plan many of the large dam projects in India. Foremost among the projects was to develop the Damodar river valley to control floods, to irrigate thousands of acres of arable land, to generate power and make the river navigable (Kirk, 1950: 413). This led to enactment of the Damodar Valley Corporation (DVC) Act in 1948.

> *River Valleys were developed "in the plains, for the plains and by politicians **and bureaucrats** from the plains (emphasis added).*
>
> Jodha, N.S.. Cited in Nagpal (1999)

To enable the development of other rivers in the country on the similar lines of DVC, the River Boards Act was enacted in 1956. The Act spells out the need to regulate and develop the inter-state rivers and river valleys or any specified projects, by setting up a River Board under the consent of the respective state governments or otherwise notified in the official Gazetteer [Article. 4 (i) (CWC, 1997)]. The board's role was to advice the participating states, to prepare, coordinate and monitor the progress of river valley projects. However, the boards can be empowered by the Central government after consultation with the respective states to implement the programme (this has rarely happened). Since Independence, a number of river boards were setup as river basin organisations (RBO) in India. These RBOs were initially expected to take-up projects and later promote river basin development. However, none have emerged really as a river basin development organisation, till date. All policies

Many of these so-called RBOs were either subject-oriented or project-oriented organisations (Chitale, 1992:43). Organisations that were confined to construct and operationalise a specific engineering project were Damodar Valley Corporation (DVC), Bhakra Beas Management Board, Tungabhadra Board, and Narmada Control Authority, Betwa River Board and Bansagar Control board. Organisations that have been set up for specific subjects were the Brahmaputra River Board and Ganga Flood Control Commission. What is disturbing is to note that most of the Boards were basically to construct and operationalise large dam projects or for a specific project (Refer. Annexure.2). What makes these boards more rhetoric than a perspective of river basin development is that they were guided with an engineering perspective of river management and they completely ignored the community involvement. This perspective lacked in comprehensive understanding of the river system for evolving various options to manage the river. Nor were they able to learn lessons from the cumulative impacts of the project. None of the organisation has done any pre or post-facto analysis of the project they implemented to assess the real costs, benefits and impacts, especially in the downstream. So far not a single river basin board has been empowered to take up integrated development of water (Vaidyanathan, 1999:109). In addition, these boards were set up meet the needs of the plains at the cost of the poor tribal and other population in the hills. All policies "are made assuming what works well in the plains should work well in the higher mountains" (Nagpal, 1999: 2717).

3.1. Irrational Approach for river management

Management of the river system has in the past been guided from an engineering perspective. One of the foremost assumptions in their perspective is that the river system functions in a steady-state equilibrium. Therefore, they perceive that the management problems in river basin are amenable to mathematical and physical solutions, through large-scale dams and embankments. One of the earliest blunders was to control flood in the plains of Indo-Gangetic plains through embankments along the banks of the rivers. This kind of development gets support from the engineers till today. At a seminar in Delft in September 1991, the Dutch representative of the Flood Action Plan remarked that they believe *'effective protection against flooding in Bangladesh is possible only by constructing a system of embankments along all the major rivers* and that this …*represents a realistic and balanced approach to a long term solution to the flood-problem in Bangladesh.'* (Van Ellen, 1991)

Their assumption was guided by an application of 'normal science' of hydraulic engineering, through various channel improvement methods (such as river straightening, dredging and snugging) the swing of the floodwater can be controlled. The Bihar State, one of the flood prone states in the country, had built about 3465 kms of embankments along its rivers till 1998 (only 160 km in 1952) and a sum of Rs 7.46 billion have been spent till 1998 (Mishra, 1998). However, these embankments have only had negative impact.[3] The embankment tries to arrest the natural dispersion of sediment on the floodplains, thereby increasing deposition, raising the level of riverbed and later breaking of embankments, causing floods and waterlogging. The flood prone area in Bihar has increased from 25 lakh hectares in 1952 to 68.9 hectares in 1998. In addition, embankments arrested the natural fertilisation of the flood plain and deprived the people who depend on these fertile soils for livelihood. Further, embankments provided a false sense of security to the increasing population to settle down along the embankments. In 1940's and 50's, the recognition of the failure of embankments to control floods led the Bihar State government to control the water through only large dams in the upstream region.

Engineers who have the traditional responsibility in river basin management, recognised that over a spatial time scale, various features of the river basin landscape evolve (mainly through vertical down-cutting of the river) and attain some sort of stable equilibrium (Newson, 1994). Consequently, they evolve empirical data to calculate the storage size of large dams based on the runoff in the catchment (as the annual flood flows), in addition to other indicators, to guide them for river basin management. The high fluctuations and erratic nature of the stream flows makes engineering measurements obsolete. The lack of reliability and discrepancies in the data is well noted in the Narmada project (Independent Review, 1992:251).

[3] The impacts of these embankments have been well illustrated for India by Mishra (1998), CSE (1991) and for Bangladesh by Adnan, (1991).

In addition the transportation in a river system is just not water alone, but its ability of the river to power transportation of sedimentation over a large area of river basin. Also as the silt deposition is a hydro-morphological process in the formation of flood plains, the basic role of the river as a drainage channel seems to have escaped the understanding of the engineers. The failure has also lead to increasing siltation in the reservoirs and thereby reducing the life span of dams. In a survey carried out by Central Board of Irrigation and Power across the country in 20 dams it was observed that the siltation rates have always been much higher than that was assumed prior to the dam construction (cited in Singh, 1998:140).

The failure to understand the river systems in a comprehensive manner has made large dams to not even achieve the desired results and there are a series of effects which engineers have not be able to accurately predict or take into consideration in dam designs. The foremost among them is siltation in the dams that has reduced the lifespan of the dams and there has been less concern among the RBOs to overcome these. The lifespan of Bhakara-Nangal dam and Hirakud dam has been reduced from 88 years to 47 and 110 years to 35 respectively (Singh, 1998). An official in Central Water Commission points out that this could have been tackled through proper planing (Rao, 1989).

Dams that are primarily meant for flood control, has in many cases increased the floods and affected the people in the flood plains. Bandyopadhayay (1987) sites from the flood in 1987 in Burdwan and Medinapur districts of West Bengal that floods occurred due to necessity of keeping a constant high level from the Damodar and Kangasabati dams, enhanced run-off from the catchment and reduced capacity of the dams.

- In 1978, Bhakra dam was faced with a controversy when heavy discharges from the reservoir caused floods making homeless an estimated 65,000 people in Punjab. In Sept. 1988, panic discharges from Bhakra dam resulted in massive floods devastating vast areas including Ludhiana, Jalandhar, Amritsar and Bhatinda in Punjab, directly affecting over 4.3 million people.
- In September 1978, floods in West Bengal affected 10 districts and 3 million people. These floods were attributed to mismanagement at the Damodar Valley Corporation.
- In case of Hirakud dam, annual average area affected by floods in the post dam years have actually increased by 54.3%. The proportion of the more damaging medium and large duration floods have gone up from 12.9% of the total floods in pre dam years to 38.5% in the post dam years. The average duration of floods have gone up from 1.61 days in pre dam period to 3.17 days in the post dam period. In Sept. 1980, hundreds of people were killed when sudden floods from the dam devastated vast areas. (Thakkar, 1997)
- The 1998 floods in Gujarat have been attributed due to mismanagement in the Ukai dam[4]. The dam got filled up before monsoon and the monsoon water was released causing floods in and around Surat. There has been petition by Lok Adhikar Sangh pending in the Gujarat Court alleging mismanagement at the Ukai

[4] Personal Communications from Mr.Himanshu Thakkar, on 6th September 1999.

dam. The dams has also caused waterlogging and health hazards in the flood plains[5].

Since the colonial period flood control has not merely been a secular march of technology against nature's perceived wreath, but of political choices, perceived economic compulsions and technological contexts (D'Souza, 1998).

Though over various time scales river can vertically cut down to sea level, geomorphological studies supported by various arial photographs, remote sensing images and temporal data has revealed that river systems also has lateral stratified functions, through meandering. The river Kosi, for instance, has moved westwards by 210 km in the past 250 years through more than 12 distinct channels (CSE, 1991: 100). It is this meandering nature of the river systems that has the maximum available energy producing currents and should be more of concern for river basin management, especially for flood control (Newson, 1994). This natural tendency to meander and sinuosity of the river systems disproves the traditional 'steady-state' equilibrium approach of the engineers and calls for a comprehensive assessment of the river system.

Large-scale storage structures, like dams, impound and divert river water are often justified on the basis that floods are caused due to upstream catchment. Therefore, controlling this catchment water through large dams will reduce flooding in the downstream, the stored water can be utilised to generate power and for irrigation in the flood plains. First and foremost is the assumption that floods are caused from upstream catchment. The technocrats fail to recognise the existence of larger catchment in the lower part of the basin, which is also capable of flooding. Analysis of rainfall data in the river Kosi between August 22-25, 1954 indicated that the rainfall in the lower part of the river Kosi created one of the worst floods (CSE, 1991:117).

Second, dams are often constructed in the upstream mountainous regions for the benefit (for irrigation, flood control, power and drinking water needs) of the people in the flood plains. Constructing dams in the fragile mountainous region leads to series of environmental impact. First among the serious impacts are of course the submergence of large tracts of lands, forests and riverine ecosystems. A large storage structure increases moisture content in the upstream regions leading to increasing and changing vegetation pattern thus creating new ecology. In addition, the increasing moisture content in the upstream will bring about new morphological changes, increasing landslides, and emergence of stream formations and increasing silt. While in the downstream, reduced flow of water and change in the ecology of the river systems will affect the prior-appropriation rights of the people living in the downstream, increase the salinity ingress, and pollution concentration, destruction of mangroves and besides serious impacts on biodiversity.

Thirdly, this approach fails to recognise the closer interaction of the mountain community with the environment, which often depend on the mountain ecosystems

[5] This has been very well illustrated by Dogra (1984), Singh (1997), Misra (1984) and Mitra, (1986)

for their livelihood. In addition, It is often assumed these mountain communities, being dispersed communities, can be easily displaced from their social and environmental settings. But the mountain communities, who are often secluded from outside world do not own formal rights to the land and other resources in the catchment, that rehabilitation policy needs. Displacing them from their local environment only leads to exposing the illiterate mass to urban slums and worsening their lifestyle, rather improving.

A fundamental problem with the macro level planning that the work of RBOs now reflects in terms of large dams based water resources development is that it is almost always at the expense of micro level needs and priorities of very large populations. Hence, such water resources development has also meant neglect of development needs of hill areas. In a sense, thus, the RBOs have almost always given higher priority to the development of the plains compared to hill regions. This has also happened because, the only development options in hill regions are invariably local projects, unlike in plain areas, where both local and macro development options are available. Since the RBOs have been biased towards macro development through large projects, the hill regions development have invariably suffered in the present RBOs. Bandyopadhyay and Gyawali (1994) recommend, "It is contended that any management approach must begin at the micro level in the upper reaches of the rivers and extend downward through the length and breadth of the entire drainage basin. In this way, the micro level and macro level managements will be bound together ecologically and will be seen as interdependent."

It is important to note here that such dichotomy between the development of plains areas at the expense or neglect of hill areas has also implied severe costs for the dams built for the plains areas. Siltation is only one of the consequences of neglect of hill region for the large dams. Other impacts include higher deforestation for the needs of plains area and due to the neglect of hill area development.

As far as energy needs are concerned, the argument could go that even the needs of the hill regions can be fulfilled from the central grids at a much lower cost. However, as Bandyopadhyay and Gyawali (1994) have noted, such apparently compelling logic must be tempered by the historical facts. The rural and hill areas right in the vicinity of many large projects have not benefited from such projects. Existing development and available assessments of options, costs, benefits and impacts of micro and mini hydro development, for example, which can cater to the needs of the hill regions, needs to be looked at in this perspective.

3.2. Comprehensive planning - a misunderstood concept

"The bland nomenclature of 'comprehensive' or 'integrated' river basin development' or 'river basin planning' masks the true meaning of terms. River basin planning has long been a euphemism for the establishment of powerful and largely autonomous agencies filled with dam and irrigation engineers who have strewn watersheds with dams and then hoped that associated energy-intensive industries and irrigation schemes would successfully follow in their wake"

McCully, Patrick 1996:19

It is surprising, how the RBOs in India have been modeled along the TVA to be multipurpose with out comprehensively understanding the river systems. The multipurpose objectives of the RBOs have been criticised, on one hand to derive maximum benefits from the single purpose projects and on the other hand to politically gain project approval. Though, comprehensive (integrated) planning and management is an ideal solution and the RBOs need to work with these perspective, comprehensive planning needs to emerge from the inter-linkage of various activities in the river basin. Many a times the multiple management objectives listed for river basin development are conflicting. For instance, irrigation and flood control, and flood control and hydropower objectives. However, one could identify complimentary management objectives, like irrigation and hydropower generation, and work towards a comprehensive management.

Further, dam builders often view the river basin problems in a macro framework, what they really need to know is to understand the problems from micro framework. It is important that any management approach begins at the micro level in the upper reaches of the rivers and extends downward through the length and breadth of the entire drainage basin. In this way, micro-level and macro-level management will be bound together ecologically and will be seen as interdependent.

What is important in river basin planning and management is to comprehensively assess and prioritise chain of complementary management interventions, which the RBO can carry out in a phased manner.

3.3. Operational Failures of RBOs

One of the failures of the existing RBOs is its inability to anticipate, assess and address the various negative impacts of the large dams and to evolve management practice to the changing environmental behaviour. For instance, the DVC though has recognised the increasing silt accumulation in the dams, it has till now not taken steps to reduce this though afforestation in the dams catchment. Further, similar to TVA, the DVC has been supplying power to the newly industrialised region. These industries are now the large polluters of the river Damodar (CSE, 1991), the DVC has not bothered to act on this.

Another major drawback has been the inability of the RBOs to address the social and economic inequality through dams. Various studies have indicated that the main beneficiaries from large dam projects have been the civil engineers, politicians,

contractors and rich farmers and landlords[6], while adversely affecting or neglecting the poor tribals and the marginal land owning communities. The RBOs with their centralised control can do little to alleviate social inequalities. It is difficult for the RBOs to assess, monitor or regulate such inequalities without adequate decentralisation measures. Though in recent years devolving power to user groups through decentralised planning has been recognised in many states[7], the actual devolution is yet to take place, in terms of power to take decisions, plan and mobilise resources for natural resource management. More significantly, such devolution that is practiced now seems to be more of a post-facto-after-thought kind of band aid solution to address the increasing criticisms that large dams and their performance face from various quarters.

3.4. Institutional Aspects of RBO

In India the DVC was the foremost among the river basin organisations, which was modeled along the lines of the TVA. This was followed by enactment of River Boards Act 1956 and later Inter-state Water Dispute Act - 1956. This led to setting up of a number of River Boards and inter-state dispute tribunal in the country. These Acts rests on the assumption that a river is a state property and that it is a commodity for the use of mankind alone (Singh, 1998). Some of the major implications of this conceptual assumption is that these laws facilitates: (i) 'water goes where people went' compared to earlier condition 'people went where water goes;' (ii) For a greater gain in the very first act of attempting to make a dam rather than in either completing, sustaining and maintaining them; (iii) Fragmentation of natural resource cycles and management systems; and, (iv) Conflict model of development of centralisation rather than a cooperative one (Singh, C., 1998).

What is significant the recognition of river basin approach by the Central government. This was further emphasised in the National Water Policy 1987 calling for various states to plan and manage river basins through boards (GOI, 1987). Though river basin planning and management through institutions has been emphasised in various policy papers, it is yet to become a reality. Some of the notable problems have been the reluctance of the government to devolve powers to the people and local institutions, existence of complex institutional structures to plan and manage the river system, political pressure in setting up of RBO and failure to understand the potentials and weakness of the management actors. To understand them, it is important to analyse the emergence of the RBO and various management institutions, and how they hinder in proper river basin management in India.

[6] For further illustration please refer to Wade (1982 and 1988), Dogra (1984) Moore (1989) and Singh (1997).

[7] The (Indian) Constitutional Amendments 73rd and 74th are the foremost among them. Though many of the states have passed a similar legislations, they have restricted the powers of the local institution more to implement programmes rather than plan and raise revenues for these. Similar measures have been adopted in Watershed Management across the country for creating watershed users. Recently, few states (Andhra Pradesh, Uttar Pradesh and Rajasthan) have come out with policy for devolving powers to water users group (mainly consisting of landowning community), but has failed to recongise the growing number of users, the industrialist, power generation companies, the urban elites and landless community. Again, these largely seem to be band-aid solutions to address the increasing criticisms against large irrigation projects.

One of the striking features of the RBOs in India is that they do not have autonomy similar to that of the TVA. Unlike the TVA that reports directly to their President, the DVC and other RBOs are responsible to a number of organisations, foremost among them the Ministry of Irrigation and Power, Central Water Irrigation and Navigation Commission (CWINC) and the state government of Bihar and West Bengal. Some think that the reluctance of the government to provide complete autonomy and political neutrality led to its failure (Klingensmith, 1998:305). The DVC completed four out of the eight dams envisioned, a thermal power station at Bokaro and irrigation barrage and canals. The power generation promoted a number of industries in the basin that led to chronic power shortage (Ibid). The power programme is still run by DVC and is more known as Power Corporation rather as a river valley corporation. On the irrigation front, they were able to increase the single crop region into double-cropped area in some of the area. However, it has not established an integrated development of resources (Ibid. 292) or has it promoted participation integrated rational decision making process. It is symbolic of such dichotomies that DVC is functioning under the control of Union Power Ministry and not Union Water Resources Ministry that controls other RBOs in India.

One of the major drawbacks of the DVC was that it never consulted the local communities. Neither loser nor beneficiaries were consulted. Beneficiaries felt that the water supplied by the DVC is a gift from the Prime Minister of India. This led to stealing of water and reluctance to support water-pricing rates of the DVC. This also led to tension between the DVC and the West Bengal government, which finally led the Central government to strip of the Durgapur barrage and the rest of its irrigation facilities in 1964 from the DVC to the West Bengal government. The siltation rate increased three times than projected and that of Maithon more than 8 times than expected (Singh, 140). A major area of failure of the DVC was on the issue of resettlement of the displaced people. On the whole the DVC failed to be environmental friendly and resource-conserving regime of the river. The river is now noted for its pollution largely from industries, which receives power from the DVC edging the river and communities around it toward ecological disaster. The case of DVC illustrates how a project for an autonomous and integrated development of river Damodar could be murdered by the self-serving behaviour of some bureaucrats in collaboration with the self-centred political leaders, engineers and contractors. The problem started with the totally non participatory, non transparent, unaccountable process of decision making in arriving at the very first conclusion that Damodar was the closest replica of Tennessee and hence TVA was the best model for Damodar basin development.

The inability of the RBOs partly rests with the existing institutional mechanisms in the country. The national policy framework (the National Water Policy 1987) provides for a holistic and integrated basin-wide approach. It calls for promotion of conjunctive use of water and water conserving technologies, pricing of water and defines the priority of water use through a participatory approach. However, the principle problem is that the policy is just a collection of general statements without detailed analysis and reflection on the local complexities. Almost 40 years of experience of planned development since independence that was available to the

government while forming the policy or subsequently was not used in framing the policy. This is further complicated by complex and compartmentalised agencies (Annexure 1).

However, in recent years, in view of participatory concepts imposed by funding agencies, formal bodies at the state level have been setup in a few states. In Tamil Nadu, under the influence of World Bank, a specialist Water Resources Organisation under the Water Resources Council and Revenue Board (WRCRB), was setup. In addition, the state has created a Water Resources Council. These formal organisations in recent years have been enthusiastic in forming Water Users Association in irrigation canals, without restructuring their functioning. Some of the states have followed suit; Orissa has set up State Water Resource Board, Maharashtra with Water Resources Authority, Punjab with Water Resources Council. The basic problem with all these efforts is that none of them are based on honest analysis of past experience, nor any of them are an attempt to form really participatory, accountable, transparent organisations for water resources development and management. This is well illustrated by Thakkar (May 1998) in an analysis of the World Bank's Orissa Water Resources Consolidation Project.

4. 'Threshold Approach' towards River Management

> ***Principles of Basin Management:***
> *Development at origin (udgamsthana) of a river (in other words, projects downstream should not proceed to development without utilisation upstream; Least interference in natural flows; Suvarna Madhya[8], understand the interdependence of nature and promote interactive and participatory nature of management.*
>
> *(Paranjapye, 1994)*

A key question now in relation to management of the river basin is to move away from the 'stability equilibrium' of the river system to 'metastability equilibrium'. This calls for river managers to understand the dynamic nature of the river systems and evolve flexible institutional and technical options for river basin management. This, called as 'threshold approach', involves 'process-oriented' investigation of the river management problems and efforts to plan and manage them needs a site-specific approach (Newson, 1994).

For instance, large dams have been justified on the basis of the ability to predict the behaviour of the river systems through various technical devices, said to be 'unbiased' and 'precise,' which can make predictions and help design technical solutions to reduce resource and hazard problems in the river system. However, such predictions are constrained due to the complex and unlimited knowledge of the long behaviour of the river system. This has led to wide spread damage to the already constructed and crores of money spent on large dams, first and foremost in reducing the life of the large dams, increasing salinity and health hazards in the

[8] The word derived from historical text means to evolve technological options that meets the existing needs of the people, other villages, the economic, organisational and societal competence.

region (this has been elaborated on the dams in India by Singh, 1998). Thus, making uncertainty in predicting the behaviour inevitable.

Uncertainties over the impact of large dams exist at different scale. Some of them are predictable in space and time (predictable impact), and therefore can propose for risk management strategies. Some of them are conceptually understood but non-detectable over space and time (uncertain impact) and some of the impacts occur over space and time about which we are ignorant (Impacts about which we don't have any knowledge). Though risk management strategy can be evolved for predictable impacts, for uncertain and ignorant impacts which occur in more numbers (Refer. Figure. 1) it is important to evolve scientific predictive measures. Dam builders who generalise these impacts only *suppress* the context-specific problem, which later emerges as a macro problem.

The inability to predict and explain the environmental change has often been lacking in the modern world, nor will be feasible in the near future. Dam builders have to recognise these limitations and metastable nature of the river system before making any long term interventions on the river systems. In view of such uncertainties over impact, EIA and CBA's have to be anticipatory and involve public for restoration of the environment.

With the growing perception of global environmental change and uncertain behaviour strategies of the river systems, RBO need to evolve strategies to prevent (acceleration of man-made intervention), adapt and manage with the dynamic nature of the river systems. Though technocratic solution is crucial, many a times it is shaped by beliefs, values and attitudes of the individual experience, which is in-turn conditioned by their social, economic and political milieu. The political economy of formation of Damodar Valley Corporation and TVA is clear illustration of these. The technocratic solution needs to be present as objectively as possible, explain the limitation of the information and evolve various options that exist.

To reduce uncertainty, river managers need to understand the behaviour of the river systems by blending scientific tools for predicting, with that of local community-knowledge system. At best the river managers in RBOs can play a major role to facilitate the objectivity through consensus and cross-fertilisation of technological options with social actors for improved management of river. The RBO should create opportunity for debate in public, where the social judgement of the community creates a natural validity around acceptance of technological options that exist in river management. This requires difference in orientation, regulation, type of communication, economic restoration and redistribution of political power through 'institutional pluralism' to manage the complex uncertainty (O'Riordan and Rayner, 1991:99, Bolin, 1994:25, Suzuki, 1995:3, Wiman, 1991).

In recent years there have been significant efforts to evolve river basin institutions, through watershed development or sub-basin development, in the country by NGOs and government agencies. NGOs across the country has been promoting organisations (formal or informal ones) to manage water. Some of the significant ones are user groups promoted across the river Aravalli in Rajasthan (by Tarun

Bharat Sangh, Alwar, Rajasthan), Chain of tanks based sub-basin development adopted by Development for Human Action (DHAN) Foundation, in Madurai Tamil Nadu and on river Kali-II in Gujarat (by N.M. Sadguru Water Development Foundation, Dahod, Gujarat).

The pressure from aid organisations like the World Bank and the Asian Development Bank has led government institutions to promote water user association (WUA) in different states, by setting up (rather renaming irrigation departments) Water Resource Organisation (WRO) or Council. Such institutions are ill conceived and are too rapid in scaling-up the "participatory" approach to suit funding agencies, to meet the financial constraints of the government and join the bandwagon of participatory governance. In addition, they fail to restructure the planning, decision making and control of the water resource organisation, like NGOs, by devolving powers to community-based institutions, that is suitable for participatory governance (Thompson, 1998). However, there is no simple solution to the participatory governance system. People also need to take an active role themselves in river basin management. More aptly called in recent days as 'co-management' of natural resources (Ostrom, 1992; Baland & Platteau, 1996).

5. Emergence of local river institutions

What makes these institutions promoted by NGOs relevant is that unlike the earlier 'top-down' approach, we see a 'bottom-up' approach emerging. What makes these institutions significant is that the role of institutions is more clearly recognised than the earlier 'technocentric' approach in planning and management of the river systems for economic development. The purpose is not to romanticise these local institutions, but to understand; how the development institutions build on their knowledge base, evolve various technological options, regulatory and monitoring mechanisms to manage the river system, through users group. What is immediately needed from the government side it to identify such user groups and hand over management to them.

5.1. Building knowledge base

One of the foremost approaches of these development institutions is that they have emerged with a comprehensive understanding of the watershed region. This involved constant and 'interactive approach' (Blaikie, 1998) with the local community in understanding their problems and solution. Tarun Bharat Sangh (TBS), an NGO in Alwar Rajasthan, began their work in rehabilitation of the pavement dwellers in Jaipur. In 1985, TBS decided to move to villages to understand the core of the problems. The Alwar district had poor natural vegetation and biological diversity, villages were in a state of severe drought and migration, with water levels disappeared and area declared as dark zone in terms of groundwater levels and exploitation, topsoil eroded and drinking water to be fetched from long distances. The rivers used to dry up just after monsoon. Agriculture could not sustain the families, thus migration. The region was food deficit. It was then that they decided to

embark on local water harvesting structures in the Arvari and other sub basins in surrounding area.

Development for Human Action (DHAN)[9], an NGO in Madurai Tamil Nadu, embarked on a demand-based approach. The selection methodology evolved for rehabilitation of tanks in south Tamil Nadu (Saravanan, 1994), has revealed the importance of chain of tanks (also called as Tank Cascades) in Thirumanimuthar Sub-basin, Madurai district Tamil Nadu. These chain of tanks not only play a major role in livelihood promotion, but also in reducing soil erosion, conserving and preserving water resource for agricultural development. In a demand-based approach, a survey was carried out to assess the perception of the people on their importance to rehabilitate these tank systems and to contribute towards their rehabilitation (Ibid.). The successful micro-level cases of watershed development and local water systems in the country like Ralegaon Sidhi, Sukhomajri, Adgaon, Baliraja have been widely known case studies which examine how successful a participatory approach have changed the lives of the poor in drought prone areas. In recent years, the massive watershed development being implemented in Andhra Pradesh (AP), under the Drought Prone Area Programme have made an impressive impact in the drought prone areas (Jairath, 1999). To provide support to these watersheds, an informal network institution have emerged in AP, called Watershed Support Action Network (WATSAN). WATSAN provides training to these watershed institutions, supports NGOs and influence policy at the State. What makes their approach interesting is that the local management of land and water was the key for ecological and economic development of the region. Various local institutions evolved their own networking mechanisms for evolving a successful programme. Other examples of successful local water systems include groundwater recharging movement in Saurashtra, work of Development Support Centre and Aga Khan Rural Support Programme in Gujarat, among others.

Community-based knowledge systems have evolved through generations based on trial and error methods in use of resource. This knowledge is intricately linked with socio-cultural and economic dimensions of the community (Banuri & Marglin, 1993). This embeddedness is the contextuality of the local knowledge base. The ignorance of this embeddedness by technocentric interventionist of the large dams has created social and cultural disaster.

5.2. Development at Origin - *Rational option for resource management*

To promote resource management, these institutions have evolved combination of technological interventions through community-based approach in the region, rather than technocentric large dams as the only option. The TBS evolved various options of *bandh*, *anicut*, *johads* and *medbandhi*, as different water harvesting structures in the Arvari and surrounding sub-basins. Until June 1997, they had constructed about 1105 structures (by now the figure has gone up to 2500 structures) of various nature from a dam of a size 1,400 feet long, 20 ft high and 50 ft width irrigating 600 *bighas* (1.75 *Bighas* equals 1 acres) to a small structure irrigating less than a *bigha*. The

[9] Formerly called as Professional Assistance for Development Action (PRADAN).

case has not been different for DHAN foundation, the command area of tanks in the Thirumanimuthar sub-basin ranges from 200 acres to 0.5 acres. Similar has been the case of N.M. Sadguru Foundation, in Dahod Gujarat, who have constructed diverse water harvesting structures in the river basin Kali-II in Panchmahal region of Gujarat. The validity of the community-based knowledge system is very often questioned for its scientific basis. Studies from the engineering perspective carried out by former faculty of Indian Institute of Technology revealed that 60 per cent of the water harvesting structures promoted by TBS were upto the engineering standards (Aggarwal, 1996). While the structures have stood the test of time more than such structures built by the government, they may benefit through modern inputs to evolve more useful structures. Sadguru's and TBS experience has proved that small scale water harvesting through community can be successful in river management (Ballabh, Vishwa & Kameshwar Choudary, 1999). What makes the communities accept such diverse water harvesting structures is its appropriateness for community to plan and manage with the available resources (physical, financial, manpower and management).

5.3. Perspectives towards basin development

In case of TBS, it was not only water harvesting that mattered but also afforestation of the hill slopes to managing the drainage of water and also preservation of wildlife. They setup number of village committees for protection of forest along with water. Further protection of fisheries was another issue that confronted them. The communities found that one problem was related to the other and finding solution to one means finding solution to others. Thus, TBS has at present enlarged to cyclic and mutually reinforcing chain of activities in the river Arvari and Ruperal. This local initiative has proved to be far more rewarding and was considered as an exemplary initiative worth for an in-depth study (UN-IAWG-WES, 1998).

Similar experience has been from Sadguru Foundation "first they got water in their village Tandi under lift irrigation and now milk has started flowing in that village under Water Development Cooperatives" (NMSWDF, 1997). Initiated to intervene through lift irrigation in 1984-85, the Foundation added social forestry in 1987 and in due course promoted rural housing development. Though these institutions view watershed as an ideal unit for development their developments are focussed in sub-micro watershed and village or hamlet level intervention (Laberge, 1994:11), having clear implications for river basin development.

Many of these community-based institutions manage resource through hierarchy and authority, but also form part of the increasingly contested political domain (Mosse, 1997, 1998). These peoples' institution were not necessarily able to resolve all resource management problems, nor do they necessarily produce equitable outcomes, though the flexible framework of management was well suited to the local people to pursue their livelihoods (Berkes, 1998:29). In recent years few NGOs (Madurai and Ramanathapuram Tank Irrigators Associations in Tamil Nadu by DHAN Foundation) and states (Krishna Bhagya Jal Nigam, Karnataka) have taken a lead to launch irrigation corporations (formal or informal ones). Though these

corporations were able to mobilise funds from the various sources and reduced the expenditure incurred by the government, they remain still financially dependent on the development institutions. In addition, these institutions needs to be more transparent and accountable in their functioning (Saravanan, 1998; Gulati, et.al, 1999). Thus it is important for the facilitating institutions to recognise these in devolving powers to community institutions for facilitation, as today all the control and powers are centralised in few institutions and hands, with no informed or otherwise participation of the communities.

The experience for facilitating such community-based institutions has met with initial resistance from government, due to fear of loosing control over resource and revenue from these. Initially met with resistance[10], the Water Users Association in recent years are negotiating with their respective Village Panchayat institution for sharing the usufruct rights. In WUA promoted by DHAN Foundation in Ramanathapuram the user group has negotiated for sharing usufructs rights at 40-60 per cent ratio, from the tank irrigation system, in terms of leasing of fisheries, sale of shrubs from tank command and others. Similar negotiations are under way from other WUA.

In Rajasthan, the user group of Aravari river who were restricted by the government in using the fishery rights in the river, have in January 1999 demanded control and use in the rights. In a most promising and path breaking kind of development, the community has set up Aravari River Parliament, consisting of elected representatives from various segments and villages of the river basin, helped by some environmentalist, government officials, legal judges and the people. Though the government is reluctant to devolve their powers, the Aravari parliament decided to manage the river through a two-tier structure. The first body, like *Lok Sabha* (like the lower house of Indian Parliament), is to have one representative from each village on the banks of Arvari. The second, like *Rajya Sabha* (like the upper house of Indian Parliament) will have a representative from each cluster of villages. One secretary and two staff are to coordinate the parliament. The parliament had also adopted a constitution to manage the river. For facilitating emergence of such institutions in large numbers with user groups promoted across the country, government will have to make provision for devolving powers to these user groups.

Promising developments of Narmada Valley, that have many lessons for future water resources development, are narrated in Annexure 1.

6. Community-based Approach for River Basin Organisation

[10] In one of the earliest Kattiampandal WUA promoted by Centre for Water Resources, Anna University, the user group had requested for control over the usufruct rights, which was denied by the then District Collector of Chengalpattu.

> The primary effect to date of river basin development in tropical Africa has been to transfer the resources of rural riverine habitats to the urban, residential, commercial and industrial sectors.
>
> Thayer Scudder, quoted in Pearce 1992: 252
>
> …….what is becoming distressingly clear is the systematic way governing elites may use river basin development projects not just to transfer resources to themselves and their supporters but also pursue self serving political goals at the expense of riverine populations, and of ethnic and religious minorities and opposition groups at regional and national levels.
>
> Thayer Scudder, McCully 1996: 241

A community-based institution such as RBO calls for understanding and building on the complex and dynamic existence of the community institutions and the environment. Such institutions for resource management need to be holistic, realistic and flexible in their approach.

In the past, technologies of river basin management have largely been guided with a perspective to control, conserve and manage through large dams. Past experience has shown that there are very serious and increasing problems with costs, benefits and impacts of large dams and RBOs having large dams in focus. Because the complexities and existence of the unlimited knowledge of the river system is inevitable, long-term prediction of the behaviour of the river system is difficult. However, understanding them is critical for river basin management. This requires not only the states and RBOs to totally restructure their role in managing of the river basins but also the local communities need to be given effective rights for informed participation. It is these communities, who are well informed about the dynamic nature of the ecological conditions. Further, they are well informed about local technology, social and economic conditions of the problems. In consequence, they are able to devise location specific rules to utilise the resources and monitor the resource management (Baland & Platteau, 1996).

To understand these local knowledge systems:

1. RBOs now dominated by engineers and hydrologists will have to incorporate much greater role for the communities and more of social science disciplines to reveal the character and various dimensions of the problem.
2. It needs to build dialogue between science and community to generate future visioning, networking, truth-telling and learning (Grove-White, Kapitza and Shiva, 1992). This will enable to understand the problems of the river systems from micro level and to evolve strategies.
3. Provide and disseminate information on the river system for evolving various options (social and technological), framework for transparent and accountable process of options assessment and management interventions in the river basins. The RBOs can then prioritise the complementary management intervention for implementation in a phased manner. This will enable the RBOs to equip themselves with various interest groups with a new kind of

professionalism for community participation and spreading river basin management.

This requires fundamental changes in the policies governing river management.

4. One of the foremost is the River Boards Act 1958. At present, the Act vests power of ownership over water with the state. This power needs to be devolved to enable the community-institutions to perform the role of managers of the resources.
5. Some states have proposed creation of state level RBOs and Inter-state RBOs.
6. Evolve regulatory and legislative framework on:

Amending legislation to enable: crearion of the new water allocation and sharing institutions; strengthened regulatory powers, pollution control measures, establishment of multi-sectoral water stakeholders associations, participation of private sector and civil society, and new forms of revenue generation (World Bank, 1998).

To devolve powers to community RBO managers need to understand the diverse existence of the community institutions and their linkages with resources. There have been number of attempts in the past (Wade, 1989; Ostrom, 1991; Baland & Platteau: 1996; Saravanan, 1999:27) and recently (Gulati, et.al, 1999) what constitutes a good community institution. More importantly these authors call for: understanding how the resource is used; allocated between users; what are the various claim-making strategies; the rules governing the use and access; and motives behind them.

7. The key need of the hour is to develop a new 'enabling environment' from the government, as it is the primary decision maker in the sector at present.
   a. Such 'enabling environment' of government requires moving away from 'centralised' to 'decentralised' means of governance.
   b. Create debate, dialogue and networking among various inter-sectoral interests groups on the importance of institutional approach for river basin management, through a framework.
   c. Facilitate, the community institutions, wherever they exist. In regions where such institutions are dysfunctional or do not exist, importance of community institutions for local-level resource management needs to be promoted.

Such an institution needs to be 'learning organisation' that is best able to adapt to the requirements for implementing and sustaining community-based institutions. This requires participation to interact with dynamic and complex community institutions and the river systems for emergence of RBOs. Such institutions will involve a rational and informed decision-making process, channels for effective popular participation and financial process, and will be able to respond to the dynamic environmental changes.

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Annexures

Annexure 1

Lessons from the struggle in Narmada Basin

The struggle by the people of Narmada Valley, led by Narmada Bachao Andolan that started in 1985 with questioning of the Sardar Sarovar Project Authorities have by now spread to across the Narmada Valley. Narmada Sagar and Maheshwar projects, under construction in the valley, are being questioned and opposed by strong people's movements at these projects. In case of already completed projects like Tawa and Bargi dams in the basin, the affected people, after their years long struggle, have been handed over the reservoirs for fisheries development. The Madhya Pradesh Government has set up a task force with members from NBA and also independent experts for reviewing and reformulating the Narmada Valley Development Plan. In case of ongoing projects like Jobat and Mann, the government has stopped construction on the projects to look into the rehabilitation issues along with NBA. Most significantly, in case of the Upper Veda and Lower Goi dams, where the construction has not yet begun, it has been agreed that a complete alternative plans for providing the same irrigation benefits in the proposed command area will be prepared by a Committee of experts nominated by NBA. Even in case of ongoing Sardar Sarovar Project, the NBA has been able to force the World Bank to review the project and subsequently get out of the project. The project is now in litigation before the Supreme Court of India. One of the participant state of Madhya Pradesh has accepted before the court that the project is hydrologicaly, socially and economically non viable and there is need for setting up a fresh tribunal to redesign the project.

These are all historical events in water resources development, made possible only due to the struggle of the people of the Narmada Valley. The struggle provides many lessons for future water resources development in India and possibly elsewhere too. Most importantly, the events show what can be achieved if people's interests were to be at the center of water resources development. It underlines the implication that large dams as planned, designed and implemented today, are not in the interest of the people.

Annexure 2

Tennessee Valley Authority (TVA)

The Tennessee river basin occupies an area equivalent of 80 per cent area of England and Wales. It was one of depressed and backward region with soil degraded on the slopes and malarial swamps in the valleys. The Tennessee Valley Authority (TVA) was established in 1933 for a comprehensive approach to natural resource utilisation and watershed management. The TVA had multiple objectives ranging from to reclaim land, conserve soil, improve productivity of the crop, promote crop cooperatives, flood-control, generation of Hydroelectric power supply. Control malarial mosquitoes and improve navigation. TVA was therefore viewed as a model for integrated watershed management in economic development. However, 1.5 billion dollars have been spent on capital schemes. Though it completed most of the envisioned programmes, at present is largely a non-profit power generating authority. In 1945, 85% of the power generated by the TVA was of Hydropower and 15% of thermal. In contrast, in 1980, 18 % was from hydropower, 66 % from thermal and 16 % from nuclear. Commensurate with the provision of cheap power, the Tennessee valley is dominated by heavy electric users and the non–profit nature of the authority makes the integrated nature of the basin management extend even to the atmosphere, in an application of modern integrated pollution control strategies.

This great world wonder (for developing nations) has been one of the large distrusted public agencies in USA, politically corrupt and gap exists between the technological emphasis and public accountability. The model has not applied elsewhere in US, but is considered as 'temple of development' in developing world. Today the TVA emphasis on the politically desirable and achievable goals (cheap electricity) than with a view to integrated watershed management. Tension not only existed within the TVA, but also with the powerful local interest groups. What is important to learn from the TVA is that many of the perceived watershed management has changed in the region, because:

1. Main environmental problems have changed.
2. Success with some of the interventions has resulted in environmental damages.
3. Many of the original objectives have become less relevant.
4. A shift has occurred from top-down to bottom–up approach.
5. The socio-political relevance of watershed region has lessened.

Annexure 3

River Basin Organisations in India

Brahmaputra Board: The Brahmaputra Board was set up in 1980 to prepare master plan for flood control in the Brahmaputra Valley, taking into account the overall development and utilisation of water resources of the valley for irrigation, hydropower, navigation and other beneficial purposes. The Board is headed by a chairman appointed by the GOI and has members from governments of the basin states. The main functions include: (i) preparation of plans for flood control and utilisation of water resources for various uses; (ii) preparation of detailed designs and cost estimates for proposed projects; and (iii) construction, maintenance and operations of multipurpose projects with the approval of the Government of India.

Bhakra-Beas Management Board: The Bhakra-Beas Management Board (BBMB) was constituted through an executive order in accordance with section 79 of the Punjab Reorganisation Act 1966 to regulate the supply of the Sutlej, Ravi and Beas rivers to the state of Punjab, Haryana, Rajasthan, and the National Capital Territory of Delhi. The Board is headed by a chairman appointed by GOI and has members from basin states. The BBMB is responsible for the operation and maintenance of the projects under its jurisdiction and to allocate water for irrigation based on inflows to the reservoirs. In addition, it will distribute power in consultation with beneficiary states. BBMB, like DVC, functions under the control of Union Power ministry, and not water resources ministry.

Upper Yamuna River Board: The Upper Yamuna River Board (UYRB) was constituted to: (I) Regulation and supply of water from all storages and barrages up to and including Okhla Barrage; (ii) maintenance of minimum flows; (iii) monitoring of return flow quantities from Delhi after allowing for consumptive use; and (iv) providing coordination for maintenance of water quality, conservation, etc. The Board is headed by the Member, Water Planning & Projects of Central Water Commission and has members from the basin states.

Ganga Flood Control Board (GFCB) and Ganga Flood Control Commission (GFCC): The Ganga Flood Control Board was set up in 1972 by a resolution of Government of India. The Ganga Flood Control Commission was set up as per Clause 5 of the resolution to undertake specific works in the Ganga Basin and for assisting the Ganga Flood Control Boards. The GFCC is expected to prepare master plan of the basin to deal with problems emerging from flood erosion and waterlogging in the region. The implementation of these will be carried out by the appropriate riparian state. A chairman appointed by the GOI heads the Commission. GOI also appoints two full time members. Basin states appoint part time members of the commission.

Other Organisations: Betwa River Board was constituted under the Betwa River Board Act-1976, for efficient, economical and early execution of the Rajghat Dam Project. The Bansagar Control Board was constituted in January, 1976, for efficient economical and early execution of Bansagar Dam and connected works, across river Sone. **Mahi Control Board** was constituted for Mahi Bajajsagar Project across river Mahi. The **Narmada Control Authority** is in charge of overseeing the implementation of the award of the Narmada Water Dispute Tribunal for planning and management and sharing of benefits from Sardar Sarovar project. (World Bank, 1998, Union Ministry of Water Resources web site, 1999)

What is clear from the origin, functions and constitution of these RBOs is that they are all structured for planning, design and implementation of large projects. It is also clear that they do not even intend to be participation oriented or open bodies. Proper river basin organisation encompassing the needs, resources and priorities of *whole* river basin or even for majority part of river basin has not been done in case of a single river basin in India.

Annexure 4

Complex Institutional Setup in India

At the national level, the Ministry of Water Resources (MOWR) is recognised as the nodal agency for water resources. While under the MOWR, there are a number of technical agencies, such as the Central Water Commission to manage surface water, the Central Ground water Board (CGWB) on ground water resource and the National Water Development Agency (NWDA) in assessing inter-basin transfer options. There are other agencies linked to the MOWR, the Indian National Committee for irrigation and Drainage, the Indian Water resources Society, Water and Land Management Institute, Central Water and Power Research Station (CWPRS), National Institute of Hydrology and others. In addition, there are agencies that are involved in various aspects of river basin management, through wasteland development, promoting drinking water and sanitation, agricultural development, pollution control and others. Though a National Water Resource Council was setup in 1983 for better cooperation, much needs to be done for it to be more effective to coordinate in action. The complex and compartmentalised institutional setup at the National level is further aggravated in the State. With irrigation gaining prominence through irrigation department. There are no formal institutional mechanisms that consider the different sectoral demands, for planning and management of water.

Annexure.5

UNCERTAINTY AND UNSUSTAINABILITY OF LARGE DAMS