Dam and its Past Present and Future – An Overview

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Abstract

This paper attempts to study the implications of **present state of dams and future** of these large projects on geographic range connectivity of freshwater. Dams have become an integral part of basic infrastructure by offering indispensable benefits like irrigation, hydropower, domestic and industrial water supply, flood control, drought mitigation, navigation, fish farming, and recreation. As controversial as they have been during the last decades due to negative social and environmental impacts, the limited and uneven distribution of water at the global level has made the world realize that more dams, mostly large dams, are needed if development is to be promoted and if basic human needs are to be covered. Overall, it has been global dynamics in terms of water, energy (including trade aspects), food, and climate securities that has recasted the role of dams triggering massive investment on construction and modernization of multiple projects all over the world. It is thus fundamental to continue improving project planning and implementation to avoid unnecessary social and environmental costs.

The changing dynamics of big dam building and development in India both re-flect and contributed to the broader transformation in the transnational polit-ical economy of dam building and development during the 20th century. A top-down, state-led, economic-growth focused and technocratic development vision, in which big dam projects played a central role, was adopted by Indian authorities at Independence. This development vision that helped legitimate and naturalize the building of big dams was more or less the same as that adopted by most states across the world. India's current and future water crisis is well-documented in India's policies and water management discourse. Large parts of India are already water-stressed. Apart from these "visible knowns," Garg and Hassan (2007) express alarm over water scarcity from the point of view of double counting of regenerated groundwater and deteriorating water quality, thereby calling for an urgent review of water policies. The large dams are projected as water security to tackle the water crisis emanating from "visible knowns," and their advantages get highlighted in plans and policies (for example, CWC 2009; MoWR 1987, 2002, 2012). But, a very crucial and grave water crisis is emanating from over 5,000 large dams in India, due to their ageing and structural deterioration of service life, which has been found to be either missing, omitted, or ignored in various policies of union and state governments, and India's water management discourse

Key words: union government, state governments, policy, dams, water management

Introduction

Pt. Jawaharlal Nehru, the first Prime Minister of Independent India undertook the ambitious task of 'dam'ming the nation. For him, dams were the *"temples of modern India".* The foundation of these sacred temples was laid in the 1st five year plan itself. Many irrigation projects were initiated by proposing dams like Bhakra, Hirakud, Mettur and Damodar Valley dam. Today, the completion of Sardar Sarovar Dam in 2013 can be marked as the pinnacle of this temple construction dream, it being the 2nd largest dam in Asia. During the inauguration ceremony of the Sardar Sarovar Dam, on September 17, 2013, Prime Minister Narendra Modi in his speech politely asserted that, *"You know me, I can't do small things. I don't think small, don't do small things. With 1.25 billion people with me, I can't dream small."*

But sometimes thinking about and doing small things, can avoid large scale harm in the future– A maxim that is observed by several Western countries such as America, in case of mega dams. The USA started building dams on almost every small and big river in the country, in order to save every bit of water available and utilize it to the fullest, in the early mid 1900s. It later had to destroy a large number of those dams built over a span of hundred years, due to reasons ranging from problem in maintaining those dams and the high costs incurred for the same to the continuous and large scale degradation of nature. The biggest example of environmental degradation is undoubtedly that of the salmons in Elwha river, who, once present in plenty, are now on the verge of extinction. Pt. Nehru realizing this harm caused by the dams, although much later in life, in one of his speeches admitted that *"the disease of giganticism*" was developing in the country, according to him, *"The idea of doing big undertakings or doing big tasks for the sake of showing that we can do big things, is not a good outlook all."* Inspite of this realisation large, mega dams were planned and built across the country, including the much disputed Sardar Sarovar Dam, whose foundation was laid by Nehru himself.

The age in which the foundation of this dam was laid was much different than the age in which it reached its final stage of completion, overcoming several hurdles on its way. It was particularly an age in which colonizing the nature and exploiting it was considered normal and vital for development, in fact the idea of development and modernization itself was different than it is thought of now. Modernization was equaled to industrialization and urbanization and nature and natural resources had little space in this development model. In turn, the sacrifice of the farmers and tribals (who were so close to nature that they were virtually a part of it) by giving away their land and their year old civilization was a negligible trade-off, for the so-called larger good of the nation. Meanwhile, rapid growth in demand for water due to population growth, increasing urbanisation, changing lifestyle and consumption patterns, inefficient use of water and climate change (together termed as "visible knowns" in this article) pose serious challenges to water security (MoWR 1987, 2002, 2012; Garg and Hassan 2007; Gupta and Deshpande 2004).

But now both new studies and experience of the developed countries has proved the harm caused by the dams. Inspite of this the construction of Sardar Sarovar was given a green signal, as "*the benefits outweighed the cost."* The benefits include, availability of water for drinking and irrigation throughout the year in drought prone regions and providing electricity to the population of Maharashtra, Gujarat, Madhya Pradesh and Rajasthan. The dam was completed shirking aside all the demonstrations, opposition and concerns raised about the environment, the rehabilitation of tribals, and the questions raised about output being 'less than equal' to the cost incurred. The output of this decision whether good or bad will be witnessed by us in the future.

We may agree that now there is no use of crying over the spilt milk as the decisions made and the actions taken cannot be undone, but at least, after learning lessons from the previous decisions we can take necessary provisions to avoid mistakes in future. Ambitious projects of this kind are excellent political moves for instant popularity, especially for governments of the current digital age with a strong public relations team. But the rights of the true stakeholders always remain neglected in this process, especially the ones who lose their land and livelihood, and therefore are naturally expected to be rehabilitated by the government. In the words of veteran social worker, Baba Amte, *"nothing can compensate the wrench they would suffer in the leaving of their traditional cultural environment."* History has shown that either the original inhabitants, including tribals or farmers, do not get rehabilitated at all, or are rehabilitated in such a poor way that most of these people end up living in filthy rehabilitation camps, whose conditions are worse than any slum in the city. This is repeated time and again each and every mega projects, which claim to benefit the poor and the needy, be it Bhakra Nangal dam, the recent Sardar Sarovar dam or displacement of tribals in Orissa due to massive mining projects.

The constant failure of the government to assure the natives of the land of their well-being and proper compensation along with the reassurance that the development projects are meant for inclusive and not exclusive development(for a particular class) has given rise to fear among the people in the regions where new projects are planned to be implemented and this fear has taken the form of widespread opposition from the locals of such places to such mega projects, which in many ways, is justified. The most recent example of this is the Nanar oil refinery plant which is planned to be built in Rajapur district of Maharashtra. Keeping aside the political drama staged in this case, the government has certainly failed to assure the locals of development and occupation opportunities that the plant would bring. For this to change, it is the responsibility of the government to assure the people that development projects, do not just bring about development of a particular sector and class of the society, but rather of the entire society.

Objective:

This paper intends to explore and analyze **dams** in **the past**, **present** trends in construction and upgrading, **the future** purposes of **dams** and **their** likely development. Also study the Reservoirs created by dams that not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use, aquaculture

Dams and Mega Projects — Development for All?

It is very encouraging to hear that India can currently store 257 billion cubic metres (BCM) of surface water in its reservoirs. Even more welcome is the prognosis that this quantity of water held in reservoirs (called "live storage") could be extended to a maximum of 385 BCM in the near future.

Such data can lead one to believe that India has enough water to ensure water security – to meet the domestic requirements of its 1.4 billion population. According to Niti Aayog, the government think tank, the country uses 634 BCM (a combination of surface and groundwater) per year to grow food, generate energy, and satisfy the needs of industry. By 2050, the population is projected to reach 1.64 billion. The figures give the impression that, with surface water storage of 385 BCM and renewable groundwater of 432 BCM, the country has a water-secure future.

The amount of surface water stored now ("live storage capacity") and the future maximum ("ultimate storage capacity") are vital for planning India's water future. Any error in the estimation of these figures will have serious repercussions. Water is one of the key drivers of India's economy. Achieving 385 BCM of ultimate storage capacity will mean the doubling, tripling, or even quadrupling of farmers' incomes, as water availability is a key input, along with credit, crop insurance and agro-investment. Increasing surface water in our reservoirs will secure India's food, energy, cities, population health and well-being, environment and economic security in 21st century and beyond.

But are the storage capacities currently projected reliable? Indian dams and reservoirs are not getting any younger. In fact, many are dying or are already dead, and are alive only on paper.

Filling with silt

Research shows that water in the reservoirs is gradually being replaced by soil, technically known as silt or sediment. Over time, the reservoirs' water storage capacity falls. A study published in 2003 found that several Indian reservoirs were designed with flawed knowledge about how fast siltation happens. For example, India's iconic Bhakra dam in Himachal Pradesh, the second-tallest dam in Asia, has a siltation rate 140% higher than was originally assumed. At this rate, Bhakra, which was completed in 1963, is expected to function for 47 years instead of the original estimate of 88 years – meaning its functional life would have ended in 2010. (This is backed up by studies showing groundwater irrigation in the Bhakra

command area has increased significantly.) The siltation rate is even higher for the Hirakud, Maithon and Ghod dams at 142%, 809% and 427% respectively.

A separate study in 2009 had similar findings. The researcher compared predicted siltation rates for reservoirs across river basins in India with observed values in the 1970s, with damning results. Nizamsagar reservoir in the Godavari river basin was completed in 1931. It was designed with an anticipated siltation rate of 29 cubic metres per square kilometre ($m^3 km^2$) per year; in 1972 the observed rate was 634 $m^3 km^2$ per year – about 2,000% greater than the rate originally contemplated. Pong dam in the Indus river basin was designed with a siltation rate of 429 $m^3 km^2$ per year, but the observed value in 1981 was 2359 $m^3 km^2$ – about 450% higher. And for Tungabhadra reservoir in Krishna river basin, the observed rate was found to be 42% higher than the designed rate. This phenomenon was observed in reservoirs across a number of diverse basins, such as Panchet and Ramganga.

Almost every academic study shows that Indian reservoirs are designed with:

1) Poor understanding of sedimentation science, and

2) Underestimation of siltation rate and over-estimation of the live storage capacity created.

As a result, the storage in Indian reservoirs is receding at a far faster rate than anticipated, with untold consequences. Several reservoirs may already be choked, given the major studies analyse data from 50 years ago.

Unlike the groundwater table, which can be replenished from high rainfall, there is no way to retrieve or replenish reservoirs filled with sediment. There is no cost-effective technology that can completely remove the silt, dispose of it and restore the live storage.

Ageing infrastructure : past of dams

About 1,100 large dams in India are between 50 and more than 120 years old, according to government data. By 2050, this will increase to 4,406. Currently, government records show there are 5,264 completed large dams, with a further 500 under construction. Besides this, there are tens of thousands of medium-size and minor dams.

As dams age, soil replaces water in reservoirs. The extra weight puts additional pressure on the dam body, leading to its deterioration. Seepage losses from reservoirs increase over time. This means that over the coming 30 to 40 years, about 80% of large dams in India could be close to being obsolete. The situation with smaller dams is even more precarious as their functional life is even shorter, varying from 10 to 50 years.

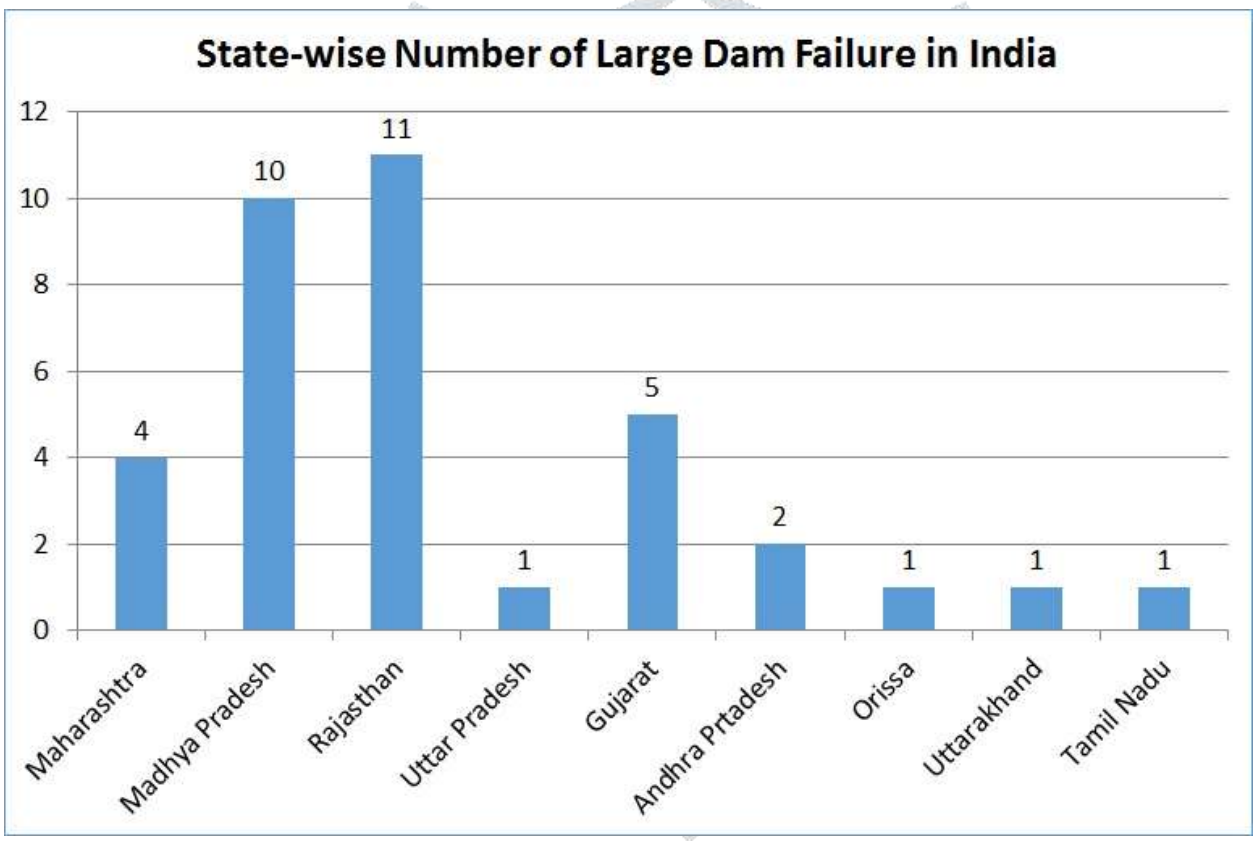
In light of this, the storage capacities of reservoirs should be revised regularly, calculating the storage space lost due to siltation and seepage. But this is not happening. The current 257 BCM live storage capacity of

all of India's dams is therefore misleading, and the estimated 385 BCM of ultimate storage capacity may in fact not exist at all.

These fallacious storage capacity figures have deluded stakeholders into believing that India has a safe and sustainable water future. This is cataclysmic.

What happens if reservoirs fail?

As soil replaces water in reservoirs, the guaranteed supply of water during the worst droughts will decline. The 140 million hectares of land covered by sown crops will either shrink or shift to rainfed irrigation, putting pressure on sparse and already over-exploited groundwater. Food security will be threatened for the future 1.6 billion people by 2050.



Under this business-as-usual scenario, we can forget increasing farmers' income – incomes may in fact fall. This will disrupt rural economies, as more than 60% of India's rural population is dependent on agriculture. And choked supplies reduces the possibility of providing piped drinking water to all rural households. No plan on climate change adaptation will succeed if reservoirs are packed with sediment.

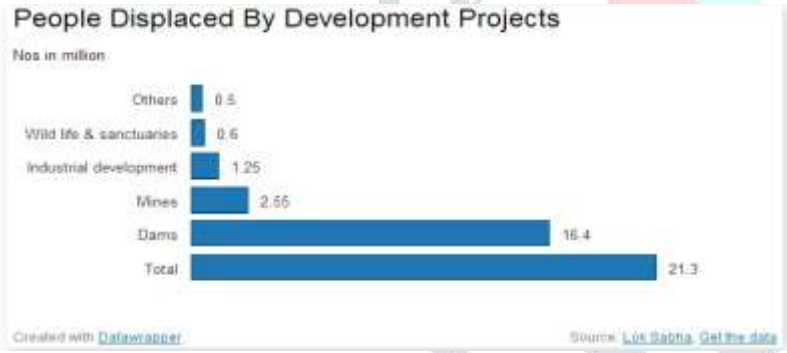
Another risk is flooding. Such disasters are happening more frequently as dams' storage space falls, leading to the release of water downstream. The Kerala floods in 2013, Chennai floods in 2013, inundation of the city of Surat due to release of water from Ukai dam in 2006, flooding of Bharuch city in 2013 due to release of water from Sardar Sarovar dam and flooding of Hyderabad city due to upstream dam releases are just some of the glaring examples.

Until now, India's water crisis has been attributed to demand. Population explosion, economic growth, changes in consumption patterns and urbanisation have been given as the leading factors in water policy and most academic literature. NITI Aayog, the government think tank, projected in 2013 that demand would be twice supply by 2013. It could be even more than that now due to supply constraints arising from the faster-than-anticipated loss of live storage.

But nowhere have water policies focused on the inevitable supply constraints caused by flawed siltation calculation rates and dying dams and reservoirs. The possibility of reservoirs' extinction in the 21st century has failed to catch policymakers' and planners' attention – but if its reservoirs fill with soil instead of water, India will have no chance of overcoming the impacts of climate change and achieving the Sustainable Development.

Future: What should policymakers and planners do

The first step is to acknowledge the fact that Indian reservoirs are dying. All water management plans based on the fallacious data concerning storage capacities should be revised. Funding has to increase for research studies auditing storage space lost and the actual space left in every one of India's thousands of reservoirs. The actual siltation rates for every reservoir have to be measured and regularly placed in the public domain.



Only then can new plans to create additional storage be devised. The additional storage can be created through smaller dams, rainwater harvesting and groundwater recharge. This is, no doubt, a massive exercise and can only be executed through institutional reform of current water organisations across federal and state governments – not by the current top-down regressive and secretive water organisations.

The outcome of the future water management of India therefore depends on how quickly the river basin-specific autonomous academic organisations and multi-disciplinary institutions are created. Complacency, suppression of data and denial of the situation by planners and policymakers will only lead to cataclysmic water crisis in the 21st century.

Conclusion

Dams are considered as agency of development for its contribution to flood management, hydropower production, irrigation, navigation and supplying water for urban and industrial needs. While many have benefited from the services dams provide, but their construction has led to many significant social and human impacts, particularly in terms of environmental costs and human displacement. Compulsory displacement that occurs for development reasons, embody a perverse and intrinsic contradiction in the context of development and it raises the major issues of social justice and equity. In this context, this book discusses on dams and its dynamics of development; River Mahanadi (Hirakud dam). The empirical scrutiny has shown that, none of the objective of the dam was fulfilled even after its fifty years of completion. On the other, it has brought massive social misery by submerging 325 villages and displaced about 100,000 people. In spite of raising development in the region, it has now brought uneven development in the command area and several environmental consequences in the locality. Thus, conflicts are taking place among various stakeholders.

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