The impact of river management on poverty and the environment in the Niger River Basin in Mali

Overview

Mali, a semi-arid country at the edge of the Sahara desert, is a ‘river-dependent economy’. The productivity of its key industries is almost entirely dependent on flow of the River Niger, which fluctuates dramatically over the year. Two dams in the Upper Niger have helped to increase economic stability and food security in the region. The first (Sélingué dam) provides electricity; the second (Markala dam managed by ‘Office du Niger’) supports a large agricultural irrigation scheme. The Guinean Government is now considering the construction of a third large dam (the Fomi dam) in an upstream tributary of the Niger.

Increasingly, the overall value of such large infrastructure developments is being questioned. Although Mali’s hydroelectric and hydro-agricultural potential could be further developed, policy makers need a better idea of the direct and indirect costs and benefits before pursuing further upstream modifications. In particular, the downstream impacts on the Inner Niger Delta need to be taken into account.

This study evaluates how dams and irrigation schemes affect the River Niger, both upstream and downstream. Different water management scenarios are assessed in terms of their impact on hydrology, ecology, economy and poverty. Overall, the best way to increase economic growth, reduce poverty and protect the environment in the region would be by i) improving the performance of the existing hydro-agriculture and by ii) improving economic activities in the Inner Niger Delta. Building a new dam would provide some additional electricity and agricultural benefits, yet these are outweighed by the longer-term social, economic and environmental losses.

Study Area

Niger, at 4200km in length, is one of Africa’s greatest rivers. Starting in Guinea, it flows through Mali and then on through Niger, before entering the Atlantic via Nigeria. Within Mali, this river can be split into two sections: the Upper Niger and the Inner Niger Delta. As a result of dam construction, the Upper Niger currently provides irrigation and hydropower. Further downstream is the Inner Delta: one of the largest river floodplains in the world. Its existence depends entirely on regular flooding by the River Niger, which inundates 25,000 km² each year, thereby supporting one million fishermen, farmers and livestock owners. Yet, out migration is increasing, as the river is an unpredictable friend to the Delta’s residents. Years with peak discharges below 4,000 m³/s occurred only twice between 1900 and 1980; in the last 20 years, they have rarely been above this level. Besides reduced rainfall and depleted groundwater, man-made structures also intensified this decline in the Niger’s flow.

This policy brief is based on the PREM Working Paper No.05-08, entitled ‘The impact of water management on poverty and the environment in the Upper Niger River Basin (Mali)’ by Pieter J.H. van Beukering, Bakary Kone, Hasse Goosen and Leo Zwarts. The full report is available online at: www.prem-online.org
Rhino Hydro-electric and hydro-agricultural schemes in the Upper Niger

The Water shortage has been identified by the United Nations Environment Programme (UNEP) as one of the most serious problems of the new millennium. An erratic water supply can exacerbate the environmental vulnerability of arid and semi-arid countries. One way to address these climatic limitations is by regulating water flow through the construction of dams and irrigation schemes. Irrigation takes a fixed amount of water throughout the year, while hydroelectric structures store water at peak flood levels and subsequently release it. The Sélèngué and the Markala dam (and associated ‘Office du Niger’ irrigation zone) jointly generate €26.4 million of (net) benefits per year to the Malian society at large, and have increased national per capita income by €68.

The hydrological influence of these two developments are felt most intensely during the dry season (March to May) and in years with low floods. During drier periods when the river is low, the Sélèngué hydropower reservoir retains around 20-30% of the river flow; likewise, the ‘Office du Niger’ removes up to 50-60% of flow to irrigate 700 km² of agricultural land.

The construction of a third dam (the Fomi), along the Guinean part of the Niger, was proposed several years ago. This 42 meter high dam is anticipated to generate electricity through an associated hydropower plant, and provide irrigation to almost 30,000 ha of cultivable land. Its planned reservoir is almost 3 times larger than that of Sélèngué, with an expected impact on river flow of the same magnitude. It is thought to require approximately US$ 250 million to build.

Downstream beneficiaries in the Inner Niger Delta

The Inner Niger Delta directly supports fisheries, livestock and agricultural production, while sustaining biodiversity of global importance. Although the Malian economy has mainly benefited from dam construction to date, hydrological interventions have had mixed (and largely negative) impacts on the delta itself (see Box 1).

Issues facing policy-makers:

• What effect do existing hydrological interventions (i.e. dams and irrigation schemes) along the River Niger have on Mali’s environment and economy? Overall, is their impact positive or negative in nature?

• What is the current value of the Inner Niger Delta? How would the construction of a third dam in the Upper Niger affect downstream beneficiaries of the river?

• Does an alternative management scenario exist that would benefit the economy, alleviate poverty, and help to protect the region’s biodiversity?

Box 1. Composition of the present value with different levels of dam infrastructure in the Upper Niger River

- Fisheries: 300,000 people in the Inner Niger Delta depend on fisheries for their livelihoods. As the Niger’s discharge has declined, so has the productivity of delta fisheries. Fish trade in the Inner Delta would be 6% higher in absence of the ‘Office du Niger’ irrigation area, and an additional 13% higher without the Sélèngué reservoir. These losses are only somewhat compensated by fisheries in Lac Sélèngué.
Livestock: Pastoralists and their livestock depend heavily on the water resources of the Inner Niger Delta. 60% of Mali’s 5 million cows are concentrated in the floodplains of the Inner Niger Delta, which provide superior grazing opportunities during the dry season. The number of cattle, sheep and goats in certain delta regions would increase by roughly 5% per year if the ‘Office du Niger’ irrigation area and the Sélingué reservoir were not present.

Agriculture: Agricultural production in the Inner Delta is governed by annual flood levels, and to a lesser degree, rainfall. At low flood levels rice production drops to 10,000 tons; with high floods it can be as great as 120,000 tons. As a result of the Sélingué Dam and Office du Niger, farmers produce around 4.9% and 10.4% less rice, respectively. However, these losses are more than compensated for by irrigated rice production in the ‘Office de Niger’ itself (which has an annual average rice production of 320,000 tons).

Biodiversity: Being one of the largest wetland sites in the world, the Inner Niger Delta is a biodiversity hotspot. Its rich aquatic life includes the hippopotamus and manatee. It sustains the last large breeding colonies of cormorants, ibises, herons and egrets in West Africa. The Sélingué reservoir and irrigation zone of Office du Niger have already had a sizeable impact on biodiversity, by reducing ecologically important habitats.

Policy recommendations

The Policy makers need to take a judicious approach when considering the overall value of costly hydrological structures. Rather than uncritically undertaking further dam construction, it would be preferable to consider whether alternative management options could better achieve the combined goals of economic growth, poverty reduction and environmental protection.

This study evaluates the direct and indirect costs and benefits of different Niger River management regimes (including the potential construction of a third dam). The incorporation of downstream interests into the analysis was made a priority, as these are typically omitted from similar enquiries (being harder to quantify economically). A combination of different valuation techniques was used to overcome this, particularly in relation to non-marketed environmental goods and services.

Researchers considered i) potential changes to the hydrology, ii) subsequent ecological impacts, and iii) social and economic effects of several different levels of hydrological intervention. These management scenarios were computer-simulated for the period 2005 to 2030, which allowed for the major environmental impacts to come into effect, while being short enough to reliably predict future developments. In addition, the study evaluated how downstream benefits in the Inner Niger Delta (i.e. livestock, agriculture, fisheries, biodiversity and transport) compared with those generated in the upstream region (i.e. electricity and irrigated crops).
Overall, this study concludes that the best management policy for the River Niger would be i) an improvement of the performance of the existing hydro-electric and hydro-agricultural infrastructure and ii) the development of economic activities in the Inner Niger Delta.

The construction of a third large dam (the Fomi dam) is not recommended, for the following reasons:

- Its creation would reduce Malian economic prosperity by €35 million per year, and decrease the total river-associated welfare by around €16 per capita per year.
- The Niger’s dams have already caused a transfer of benefits from the Inner Niger Delta to the Upper Niger region. This would be further exacerbated by the Fomi dam, which substantially benefits Guinea at the expense of Mali.
- Construction costs of a third dam would only partly be compensated for by additional electricity and agricultural gains. Moreover, the indirect downstream losses in terms of declines in i) fish trade (of up to 37%), ii) livestock numbers (of up to 15%), iii) rice production (of up to 40%) and iv) ecological value (of at least 36%) would overshadow these direct revenues.
- Declines in these key economic sectors would cause further out-migration in the Inner Niger Delta.
- The vulnerability of the Inner Niger Delta to drought would be greatly increased by the construction of the Fomi Dam.
- The new dam’s water demands could also severely compromise the ‘Office du Niger’ irrigation area. This area’s rice production covers around 40% of national demand: it represents a secure food resource, independent of rainfall and flood performance. An additional dam could constrain the planned doubling of rice production in this zone over the coming years (a prerequisite for its economic feasibility).
- The construction of the Fomi dam would have a significant bearing on the biodiversity of the Inner Delta, and may push internationally significant populations of waterbird species to the edge of existence.