

# The Observatory of Niger Basin Authority – A tool for trans-boundary integrated water management governance

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## Abstract

The Niger River basin involves nine countries that depend on its water resources for agriculture, energy supply, drinking water, breeding and navigation needs. It has also a major role for environment in a very fragile area. Water availability in the basin is very variable and there is threat of tension between the states of the basin if water is not shared properly. It is therefore necessary that the states can converse and agree to water distribution of the available water resources with good equity. In this aim, Niger Basin Authority (NBA) was created to allow permanent place for dialogue between states. However, a productive and equitable dialogue built on objective basis is necessary. The observatory of the NBA has been created for that goal. The conception of this observatory is described. This observatory must not only work on data of the year about climate and hydrology but also allow a sharing of knowledge so that every state would be at the same level of information to make suitable decisions. The French Foreign Ministry in Echel-Eau project supported a global diagnosis on water productivity according to the methodology initiated by the Challenge Program “Water and food”. This global diagnosis named “Basin Focal Project” leads in a knowledge data base that will be implanted in NBA. The concept of this base will is described .

## Résumé

Le bassin du fleuve Niger comprend neuf pays qui dépendent de ses ressources pour leurs agricultures, pour leur approvisionnement en énergie et pour les besoins en eau des populations. La disponibilité en eau dans le bassin est très variable et il y a une forte menace de tension entre les états du bassin si le partage de l'eau n'est pas fait de façon équitable. L'Autorité du Bassin du Niger (ABN) a été créée dans le but d'avoir un espace de dialogue permanent entre les états. Cependant, afin d'avoir un dialogue productif et équitable il est nécessaire que celui-ci soit construit sur une base objective. L'observatoire de l'ABN a été créé dans ce but. La conception de cet observatoire est décrit. Celui-ci ne doit pas seulement travailler les données annuelles sur le climat et l'hydrologie, il doit aussi permettre un partage de la connaissance afin que chaque état soit au même niveau d'information afin de prendre les décisions les plus fondées. Le Ministère français des Affaires Etrangères et Européennes au travers du projet Echel-Eau a financé un diagnostic général de la productivité de l'eau, suivant une méthode initiée par le Challenge Programme « Eau et Alimentation ». Ce diagnostic global appelé « Basin Focal Project » a permis la création d'une base de connaissance qui sera implantée à l'ABN. Le concept de cette base sera décrit.

## The Niger Basin

The Niger is 4200 km long (3<sup>rd</sup> of Africa and 9<sup>th</sup> of the world). Its area is about 2,100,000 km<sup>2</sup>. It involves Algeria, Benin, Burkina, Cameroon, Guinea, Cote d'Ivoire, Mali, Niger and Chad. Only 1,500,000 km<sup>2</sup> is hydrologically active (figure 1). The Niger crosses a large variety of climates with rainfall from 2,000 mm to 200 mm.

The result is a large variation in the water resource, according to the location, and from year to year. 88,000,000 inhabitants are concerns by the Niger flow, for irrigated crops, breeding, energy supplies drinkable water and navigation. Moreover, Niger has large importance for environment as stopping place for bird migrations and for animal conservation with a lot of “Ramsar” areas. It could be considered like a barrier against desertification.

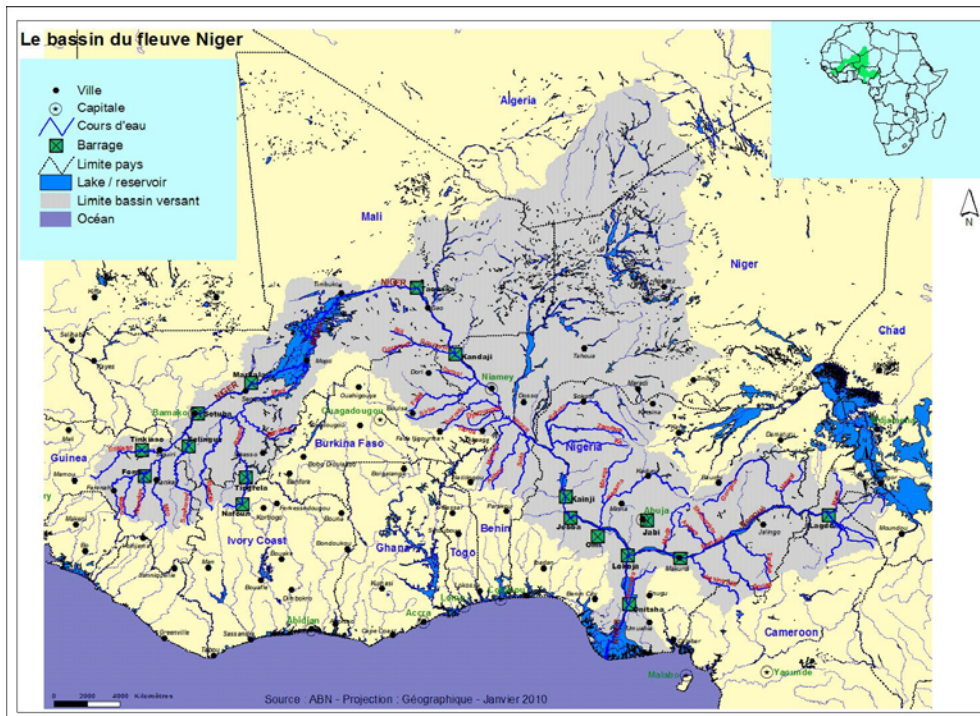


Fig. 1. Figure 1 Niger River basin

With nine states, involved, the Niger basin is very involved in Trans-boundary integrated water management and in the environment challenge of the African continent.

A dialog between the nine states is so necessary otherwise there would be threat of tension between these states. For instance states located in downstream would be wronged if states located in upstream use too much water, and could be tempted to assert to water supply.

### The Niger Basin Authority

The Niger basin Authority (NBA) was created in 1980. Its aim is to promote cooperation between the nine riverside states and operate an integrated development of the basin particular in energy, hydraulic, agriculture, breeding, fisheries, transport and industry domains. The main objectives are:

- Harmonization and coordination of national water management policies.
- Implementation of an integrated plan for Niger basin development.
- Implementation of management of dams and common projects
- Control and regulation of navigation on the river.
- Expression of assistance and studies necessary for basin development.

In 2002, the nine governments decide to implement a shared vision of basin development and a plan of action for sustainable development.

### The Niger Basin Observatory (NBO)

The ground and water degradations are due to climate change and human activities. It is necessary to take in consideration environmental factors in the decision of water management. These suitable decisions are possible if we understand the degradation process and take in consideration the impact of human activities and practices on the natural resources. It is thus necessary to have a better knowledge of the causes and consequences of environmental degradation. For that aim, international cooperation in research and scientific observation must be reinforced.

In the Niger basin, this cooperation is possible if the nine riverside states agree to coordinate and harmonize data collection and to share information. They must also realize systematic observations of environmental components and evaluate the effects of degradation.

It is also important to gather the results of a lot of projects and studies implemented in the basin.

To operate a long term survey of the basin ecosystem, the nine riverside countries of Niger decide in 2004 to create the NBO in the NBA head office.

The aims of NBO are:

- To survey hydrologic evolution of the basin.
- To produce of periodical information on the basin development from collected data.
- To disseminate useful and reliable information to governments and stakeholders.

NBO is supported by Fonds Français pour l'Environnement Mondial (FFEM).

NBO results expected are:

- A database to define domains, indicators, environmental and socio-economic parameters for a short, medium and long term survey.
- An environmental and socio-economic data collection from the nine riverside states.
- A list of environmental and socio-economic parameters for a long, medium and short term survey.
- Current situation to evaluate future evolution.
- An atlas of Niger Basin in order to capitalize and inform stakeholders and decision-makers on the current situation of environment and socio-economy in the basin.
- Standardization of data management with a guideline.
- An integrated data management system : control panel on environmental situation, control panel on water management, database linked with a GIS, information bulletin model, monitoring and management tool of various projects and programs, data mining systems etc.
- An Internet site to favor data sharing and dissemination.
- Studies and research to improve current situation.
- A plan of development with capacity building actions to implement actions and a financial plan.

These actions are made with a partnership with other river basin agencies (Senegal River, Volta River) and data collection institutions (OSS, CILSS...)

## NBO data management process

Data come from national network:

- Ministries that are in possession of data from national services.
- NGO that produce data.
- Others institutions.
- National thematic institution (research, universities...).

These data are collected by national focal institutions that represent NBA in each country

Each country (Burkina, Cameroon, Benin, Chad, Nigeria, Côte d'Ivoire, Guinea, Mali and Niger) sends their data to NBA head office.

NBO receives also data from international and regional institutions.

All these data are integrated in the NBO data base, also fed with other data bases used in NBA.

- Niger-Hycos Data base (due to the Niger Hycos Project, part of the Whycos international project).
- Geo-referenced data base.
- Silting up data base.
- GEF data base.
- Documentation data base.
- Mike basin Model.
- Hydrological model.

These data are used to produce intermediate products:

- socio-economical and environmental parameters,
- current situation,

- sharing and dissemination platform.

They are also used to produce final products

- meta-data catalog,
- control panel on environmental situation,
- atlas,
- Report on environmental situation, hydrological balance, water management...
- periodical information bulletins.

All these products are disseminated to the riverside countries and international and regional partners.

## Knowledge data management

The French Foreign Affairs supported Echel-Eau project whose main object is to develop new tools to facilitate river basin management.

One of the parts of this project is to implement a global diagnosis on the Niger basin by using methodology conceived by Water and Food Challenge Program.

In this diagnosis, a knowledge data management system is one of the work packages, implemented by IRD. NBA thinks that this system can improve the NBO data management.

### Objectives

The objective of the development of the Knowledge Database is to gather a collection of data documents, maps and reports. All documents, maps, reports must provide enough information about water and poverty in the Niger Basin and deliver at the end of the project a set of suitable data and information to the main end-users of the basin, i.e. the NBA. This set of knowledge information must be also put down at the end of the project to the Integrated Database Information System (IDIS) Database: the on-line data sharing platform focuses on IWMI and CPWF basins.

The main task carried out concerned the modelling and setting up of a knowledge base on the Niger. It is required for the homogenisation of knowledge in matter of water and its relation to poverty. This knowledge comes from already existing databases managed by scientific and institutional actors within the Niger basin, and from information supplied by the different Work Packages of the project.

### Knowledge Data

The database architecture was built to manage principally two main kinds of data: the first is the time series type data such as hydrological and meteorological measurements. The second could be defined as a reference document and concerns every file containing information. That could be a scientific publication, a report, a PowerPoint presentation etc. Both types of data have to be described by a set of specific information called metadata. The Metadata structure adopted for the description of time series information follows the ISO 19115 standard. The Metadata structure to describe a reference document is inspired by the common description used for a scientific publication. The system allows for both types of data, the option of storing only the metadata in the database if required. This specificity enables to take into account data as an URL link for example or to list a set of well known stations even if there is no right accessing to the data itself.

#### *Managed Data types*

The high number of actors (managers, data producers, users etc.) with different status (administrative services, private or public organisations, research institutes etc.) and thus, the data process, dissemination and exploitation, the expanse of the basin, the delay to collect data as well as the short duration of the project, impose to optimize with a preliminary time to think.

An investigation phase was necessary and had required exploiting every document collections particularly the one of the Niger Basin Agency and those of its partners.

A quick assessment of the meteorological data of the Niger basin provides more or less nine hundred meteorological stations and five hundred hydrological stations. The Niger Agency Basin linked with all the Hydrologic and Meteorological Departments within the basin was the natural partners to populate those types of data into the Knowledge base.

Hydro Sciences Research Unit (HSM) provides some GIS Layer information such as the Niger basin hydrographical network with all rivers named and organized into a hierarchy. Other GIS layers provided by HSM are the outline of the basin, the layer of geology cut at the basin outline, the Holdridge vegetation classes and the Water Holding Capacity of the basin at a half square degree. Moreover, the basin agency and the national services will be approached to add more GIS information in the knowledge base.

#### *Chronological series*

Unfortunately, for different reasons, NBA did not get involved in the first phase of collecting hydro-meteorological data. Therefore, Knowledge Database leader was forced to put into the database only free information as the time series collected at the synoptic stations.

This represents a set of more or less 730 time series and 42 synoptic stations.

#### *Knowledge data*

This kind of data represent the more common type of data we get in this project. Of course, the database manages document formats as different as text files, world PowerPoint, Excel, PDF, JPEG etc. and photo albums of the most representative place and device (stations, dams etc.).

Using this naming and this format, it is possible to store different type of information as Socio-economic Data which cannot be modeling as logical as a Time series. Such general information is coded inside a word document or more often in an excel file. Dissecting such document in a DBMS table reduce the meaning and the sense of such information type. That is why we choose to store directly entire document into the database and to apply the technology called Integral Text Index.

This index is used indexing and querying non relational and unstructured text stored in the database. It allows for words to be searched for in the text columns. SQL Server Full Text Search service can be more efficient to organize unrelational data as we are describing.

In this data type we can managed document files such different as Installing Report, Studies, Bibliography, student PhD or Master report etc.

#### *Metadata standardization.*

The Metadata structure adopted for the description of time series information follows the ISO 19115 standard. The Metadata structure to describe a reference document is inspired by the common description used for a scientific publication. The system allows for both types of data, the option of storing only the metadata in the database if required. This specificity enables to take into account either data as an URL link for example or to list a set of well known stations even there is not access to the data itself.

Metadata are data that gives information on the nature and the characteristics of other data they refer to. They thus hold any piece of information linked to a data except the content of the date itself. Metadata allow to inventory the data (make a list), but also to document (describe the characteristics) and to catalogue them (i.e. class according to various criteria).

In order to structure, the metadata used to reference the data sets and to permit making the references to be shared by another application, the system proposes to settle for the international metadata standard for geographical information (ISO 19115). This standard answers the needs for describing the environmental information to be managed. Some scientific community had already defined patterns for this standard (kinds of “view” of the standard) the system adopts these patterns. For instance, WMO (World Meteorological Organisation) defined a pattern for writing the metadata of the meteorological data.

## Conclusions

A suitable integrated management of river basin is a hard work because riverside countries often have conflicting interests. In the Niger Basin like in other basins, it is necessary to arbitrate between agriculture, fisheries, energy, water supplies, navigation, and water drinking needs and with environmental constraints. It is also necessary to arbitrate between the states needs and to share water

resource between upstream and downstream countries. The negotiation between states or users is the only solution and river basin agency like NBA is a proper place to set up this debates.

But negotiations cannot be fair if the partners have not good data and information to back up their arguments and propositions.

To set up a data management system is the best solution, but the condition is that these data must be approved and confident by all the partners.

The NBO objectives are very ambitious because they must gather a lot of type of data (climatic, hydrologic, socio-economic...). The results of this observatory are determined by the quality of the basic data collected by the states that must have the ability to do this important contribution. It is also necessary to have a system to manage a lot of data and to produce suitable analysis and information. This is the role of NBO and the technology of knowledge date system can provide a good help to organize this management.