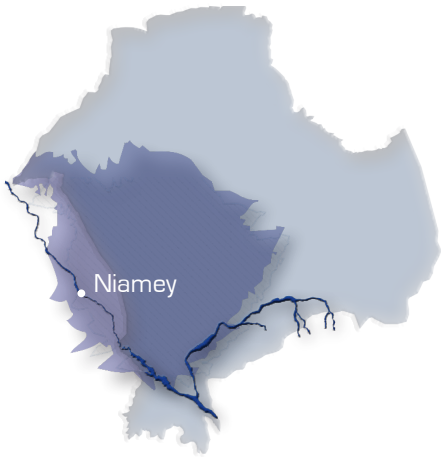
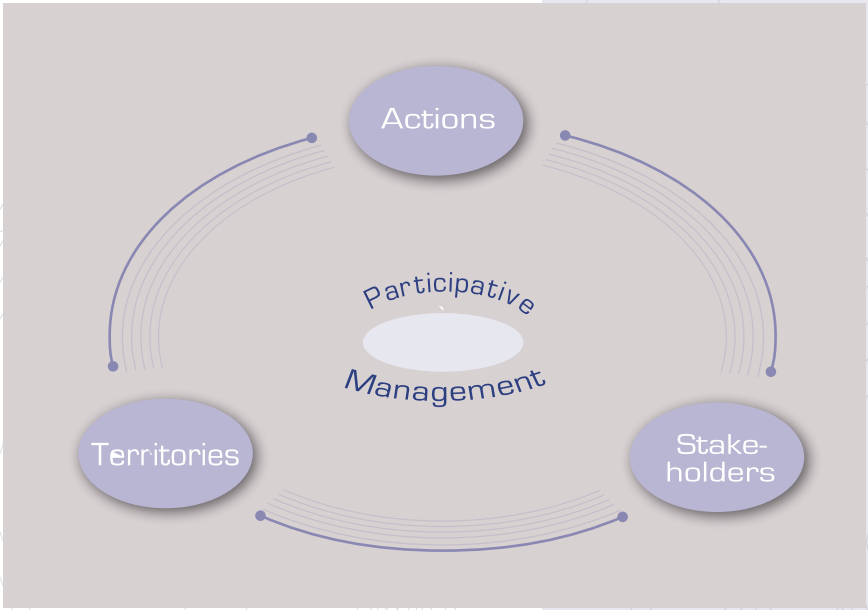


Iullemeden Aquifer System

Mali - Niger - Nigeria

Volume IV

PARTICIPATORY MANAGEMENT OF TRANSBOUNDARY RISKS



OSS SAHARA AND SAHEL OBSERVATORY

Iullemeden Aquifer System

Mali - Niger - Nigeria

Volume IV

PARTICIPATORY MANAGEMENT OF TRANSBOUNDARY RISKS

Strategic elements

Tunis, 2011

Other documents (IAS)

Volume I : Transboundary diagnostic Analysis

Volume II : Common Database

Volume III : Hydrogeological Model

Volume V : Monitoring & Evaluation of transboundary aquifers

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Water Programme coordinator

Abdelkader Dodo

Executive Secretary

Dr. Chedli Fezzani

Contents

LIST OF ACRONYMS/ABBREVIATIONS

ABN	Autorité du bassin du Niger
ADT	Analyse diagnostique transfrontalière
AEP	Adduction d'eau potable
ALG	Autorité de développement intégré de la région du Liptako Gourma
ARM	Autorité de régulation multisectorielle
AUE	Association des usagers de l'eau
CBLT	Commission du bassin du lac Tchad
CCSEA	Comité de coordination du secteur Eau et Assainissement
CEDEAO	Communauté économique des États de l'Afrique de l'Ouest
CEEAC	Communauté économique des Etats de l'Afrique Centrale
CEMAC	Commission de la Communauté économique et monétaire de l'Afrique centrale
CGPE	Comité de gestion de points d'eau
CILSS	Comité inter-Etats de lutte contre la sécheresse dans le Sahel
CMNN	Commission mixte nigéro-nigériane de coopération
CNAT	Comité national d'aménagement du territoire
CNE/A	Commission nationale de l'eau et de l'assainissement
CNEDD	Conseil national de l'environnement pour un développement durable
CNUH	Commission nationale de l'urbanisme et de l'habitat
CSHP	Conseil supérieur d'hygiène publique
EU	European Union
FAO	Organisation des Nations unies pour l'agriculture et l'alimentation
FEM/GEF	Fonds pour l'environnement mondial (Global Environment Fund)
GIC	Groupe d'intérêts collectifs
GIRE	Gestion intégrée des ressources en eau
IEC	Information - Education - Communication
IMF	Institut de microfinance
MH	Ministère de l'hydraulique
MINI aep	Mini-adduction d'eau potable
NEPAD	The New Partnership for Africa's Development (Nouveau partenariat pour le développement de l'Afrique)
NTIC	Nouvelles technologies de l'information et de la communication
OCB	Organisations communautaires de base
OMD	Objectifs du Millénaire pour le développement
ONG	Organisation non gouvernementale
OSS	Observatoire du Sahara et du Sahel
PADD	Plan d'actions de développement durable du Bassin
PHI	Programme hydrologique international

PIB	Produit intérieur brut
PMA	Pays les moins avancés
PMH	Pompe à motricité humaine
PNE	Partenariat national de l'eau
PNUD	Programme des Nations unies pour le développement
SAI	Système aquifère d'Iullemeden
TCP/RAF	Transmission Control Protocol (Protocole de Contrôle de Transmission) / Bureau régional de la FAO pour l'Afrique
UGE	Unités de gestion des eaux
UICN	Union internationale pour la conservation de la nature
UNESCO	United Nations Educational, Scientific and Cultural Organization (Organisation des Nations unies pour l'éducation, la science et la culture)
VIH/SIDA	Virus de l'immunodéficience humaine/Syndrome d'immuno déficience acquise
WWF	World Wide Fund for Nature (Fonds mondial pour la vie sauvage)

I. INTRODUCTION

Participative management is involving all the stakeholders according to a sector policy. This means setting up a **consultation framework** between the stakeholders of one determined sector (the case of managing water or land resources) with as objective taking the solutions in case of problems or situations which may threaten directly or indirectly the existence of resources or the sector.

The Iullemeden basin (IAS) is shared by three countries: Mali, the Niger and Nigeria. It abounds with surface and ground water resources very exploited by the populations of the three countries.

These water resources are faced with important hydrogeological risks mainly three major ones::

- reduction of resources in quantitative and productivity terms;
- the degradation of the quality of the water resources in the basin;
- climate change affecting the IAS basin in general and the basin water resources in particular.

The project is one of the first GEF projects involving shared aquifers and focused on a consultative management action of water resources. The efficient management and the prevention of transboundary risks are based on participation, awareness-building and inter-governmental communication.

Activities must take into consideration the water and land users as well as the other involved parties through national and regional workshops.

Activities include **an initial assessment study of what is existing** which describes the current situation and identifies the opportunities and constraints in involving the parties concerned in participative management. This study must describe the risks and make propositions for the implementation of the selected policies and strategies. The study must reflect a well-analyzed experience at the level of the concerned countries and assess the scope of collaboration with existing and future participation and awareness-building programmes in the field of natural resources or agriculture in each of the countries.

The preliminary analysis of the involved parties shall be expanded and developed into a joint assessment of needs and into a practical and efficient approach for the participation and awareness-building programmes of local communities and other water users and involved parties in order to examine each user's rights and responsibilities (duties).

The study will develop the mentioned programme and initiate pilot plans in two representative zones for the management of high risks and vulnerability to climate change and change in the use of lands for the sake of a consulted participation and awareness-building programme in the basin. The objective will be assessing concerns related to transboundary risks and setting up the policies for their reduction at the local level.

The expected results are **the elaboration of the elements of a participation and awareness-building strategy for the management of transboundary risks**.

In fact, these results can be achieved only if we propose a long term participative management and awareness-building plan which will be elaborated by reference to the experience of pilot schemes and the capacity of local water resources management in the IAS.

Based on experiences of pilot programmes and a long term IAS participative management plan, the study have been discussed within a regional workshop in order to be implemented at the basin and national levels.

II. GENERAL CHARACTERISTICS OF THE IAS

II.1. Physical and climate frameworks

The Iullemeden Aquifer System (IAS) is located in the arid and semi-arid zone of Western Africa. It corresponds to a portion of the watershed of the Niger River known as the "The Mid Niger". The ecology of the basin is mainly determined by climate factors mainly rainfall and temperature. Rainfall in the Niger basin is characterized by a high gradient: less than 50 mm in the North and over 800 mm in the South. The position of the normal annual isohyets defines the four climate zones (figure 1) :

- Sahara zone (Rainfall less than 150 mm);
- Nomad Sahara zone (rainfall from150 to 300 mm/year);
- Sedentary Sahel zone (rainfall from 300 to 600 mm/year);
- Sahel-Sudanese zone (rainfall from 600 to 800 mm/year).

The nomad Sahel zone is dubbed “pastoral zone”

The “cultivation zone” is located in the southern part of the isohyet’s 300 mm. It covers the sedentary Sahel zone and the Sahel-Sudan zone: It is the area of pluvial cultivations (millet, sorghum, corn, cowpea, ground nuts, cotton, etc.).

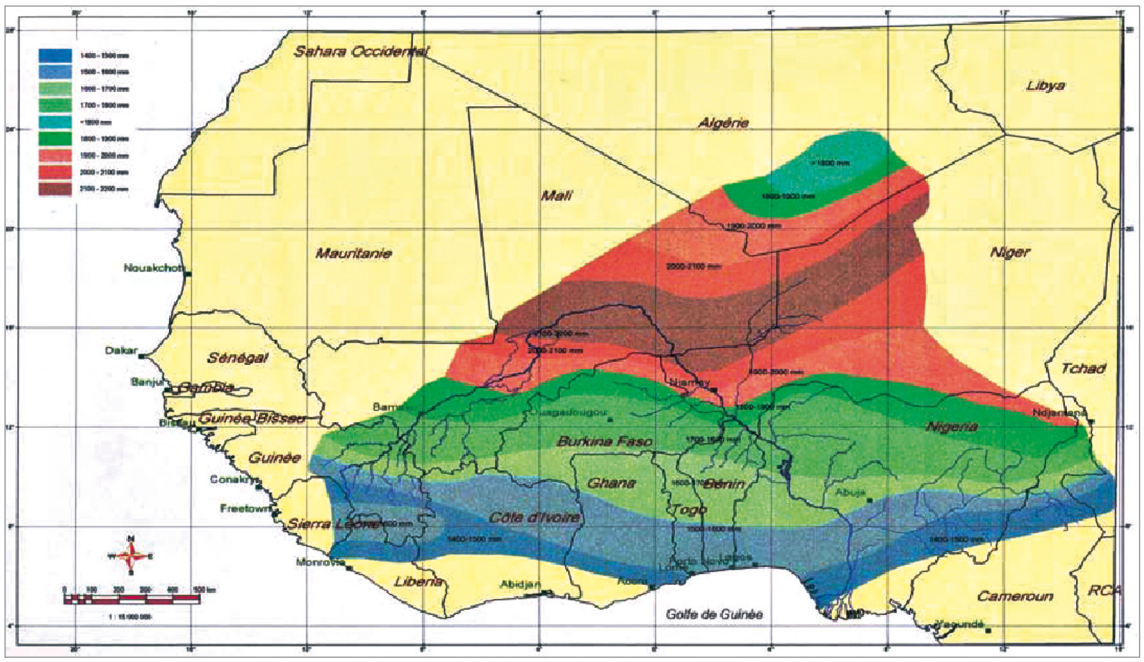


Figure 1: Map of the climate zones in the Iullemeden basin

The Iullemeden Aquifer System, shared by three countries: Niger, Mali, Nigeria, is framed to the North by the Hoggar, Aïr and Iforas Adrar crystalline basement which constitute the Touareg Shield, to the South by the Jos Plateau (in Nigeria) and the Liptako-Gourma to the West (figure 2).

It is full of sedimentary formations which range from the Cambro-Ordovician to the Tertiary and Quaternary. In this case, the Iullemeden Aquifer System is also shared by Algeria and Benin. Taking into consideration the Aquifer formations of the Continental intercalaire (Cretaceous), of the Terminal Continental (Tertiary and Quaternary) and the Niger River (potentially boundary conditions), the System is limited to Mali, the Niger and Nigeria (Table 1). It covers an area of 500 000 km^2.

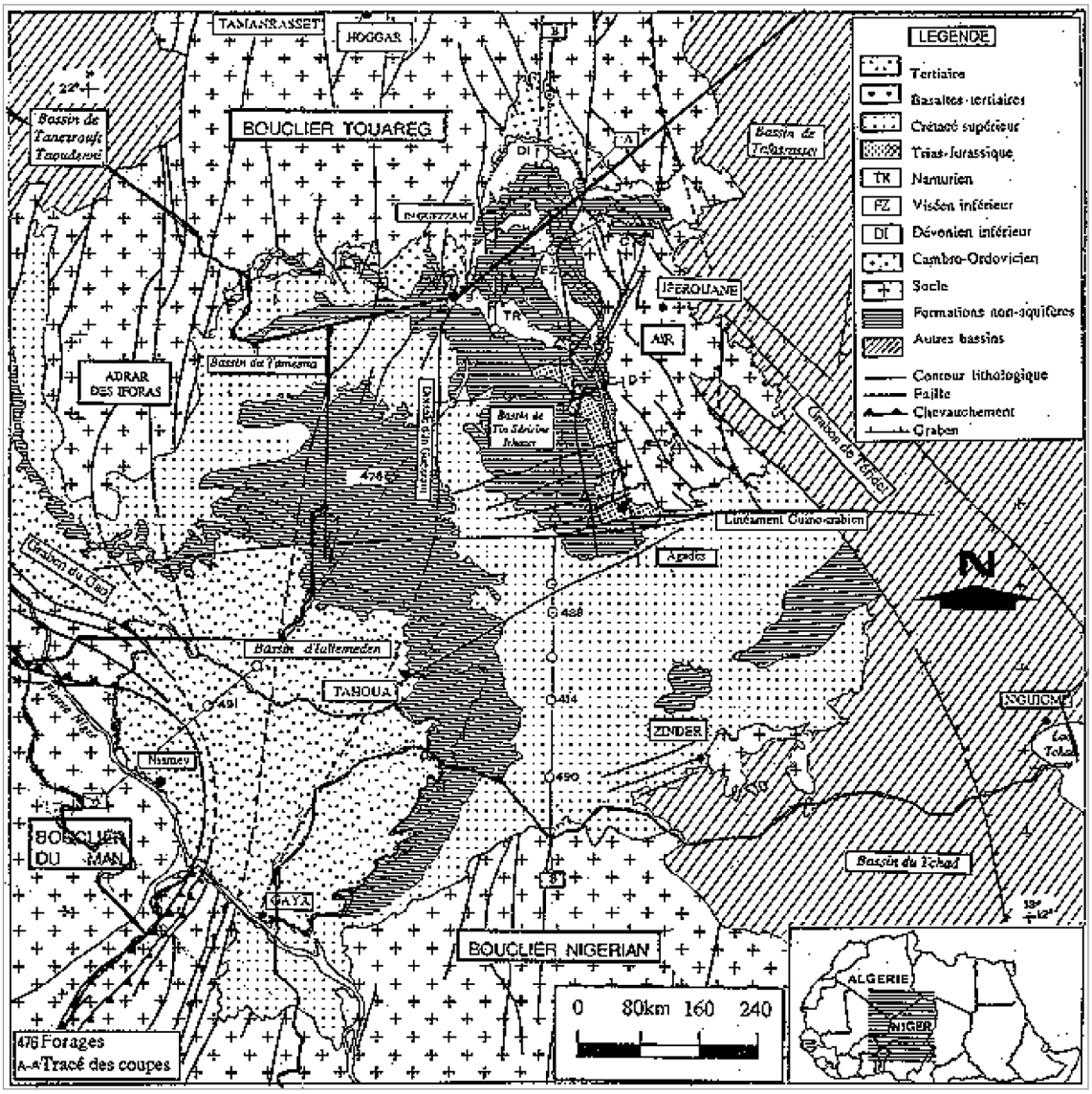


Figure 2: Geological and hydro-geological frame of the Iullemeden Aquifer System (Dodo, 1992).

The table is the correlation between the Litho-stratigraphic realized from lithological data of the drillings and the geological data in the national development plans for the management of water resources.

II.2. Socio-economic aspects of the three IAS countries

II.2.1. Population and facts

The IAS basin constitutes an important reference foyer for population and economic dynamics because of its immense natural resources. The basin's demographic structure is highly characterized by the spreading out of historical poles. The basin's population, composed of a multitude of

Age		Mali		Niger		Nigeria	
		Group	Formation	Group	Formation	Group	Formation
Quartenary		Quartenary	Alluvial, **Aquiferous** dunes	Quaternary	Alluvial, **Aquiferous** dunes	Quaternary	Alluvion **Aquifer**
Tertiary	**Pliocene**	Continental Terminal	**Sandy limestone and clay Aquifer**	Continental Terminal CT_3 **Aquifer**	Series of clay. Sandstone of the Middle Niger	Continental Terminal	Gwandu **Aquifer**
	Miocene			Continental Terminal CT_2 **Aquifer**	Clay sandy series with soft coal		
	Oligocene			Continental Terminal CT_1 **Aquifer**	Siderolithic seriese		
	Eocene	Middle Eocene	schists				
	Palaocene	Terminal Palaeocene	Limestone and sandy marlstone with phosphated level	marine origin Palaeocene	limestone, papayrus schist	Sokoto	Kalambaina **Aquiclude**
		Lower Palaeocene	Limestone and sand **Aquifer**				Dange
Cretaceous	**Upper Cretaceous**	Senomanian - Maestrichtian	Clay sandstone **Aquifer**	Turonian –Sénonian (2-3 layers)	Sea cretaceous (White limestone)	Rima (Maestrichtian)	Wurno **Aquiclude**
							Dukamaje
							Taloka **Aquiclude**
	Lower Cretaceous	Continental intercalaire	Quartzitic Grey, micro-conglomerate arkoses , Sand and clay of Tegama **Aquifer**	Continental intercalaire **Aquifer**	Continental Hamadian	Continental intercalaire / Continental Hamadian	Gundumi & Illo **Aquifer**
					Farak clay		
					Tegama sandstone		

Table 1: Litho-stratigraphic correlation between Mali, Niger and Nigeria

ethnicities, is unevenly spread out spatially. The space occupation is often decided by the potentials of the zone.

The population is young and predominantly feminine. About 44% of the basin's population is under 15. The average demographic growth is 3% per year. The majority of the basin's population works in agriculture and lives in a rural environment but urbanization is progressing. The current rate of urbanization in the basin is around 26% and 33% in the totality of the countries.

According to the World Report on Human Development - UNDP-2002, the population of the basin will be marked in the long term by a high rate of urbanization of about 50% with a predominance of semi-urban centres (population higher than 5000 inhabitants). However, the rural component of the population will be a long-lasting phenomenon of human presence in the basin according to an uneven distribution in space. The lower part of the basin will be more urbanized than the higher and Sahel parts where the part of the population living in the rural areas is expected to remain higher.

The IAS groups essentially poor countries which are part of the Less Advanced Countries (LAC). Some are Sahel countries in an enclave and subject to a tropical climate of the Sousanis-Sahel type characterized by recurrent drought and increasing desertification during the last decades. Besides this extremely austere physical environment, these countries are developing in an extremely difficult environment with an economy dominated by agriculture and stock-breeding. These activities generate 40 to 60% of export receipts and employ 80 to 90% of the active population. The average growth rate is 3%. The average per capita GDP is estimated at $US 350/yr in 2000.

This modest economic growth has not been followed by a real distribution of wealth. The majority of the IAS population remains poor. This situation affecting an important part of the population explains the weakness of the human development in the IAS member states.

The socio-economic context of the basin has characteristics which are similar to those of the totality of the country with a predominance of problems related essentially to the sustainable management of natural resources and water in particular. The basin remains an important demographic zone characterized by ethnic diversity which is the base of the plurality of conceptions behind the organization of social life and production relations. It is nowadays a zone attractive for immigration because of the more favourable agro-ecological conditions.

The social conflicts related to the exploitation of the basin's water resources are very common and involve cultivators and livestock breeders or the autochthonous population to the migrants. Besides these recurring social aspects, the basin's economy suffers from weak and insufficient socio-economic infrastructure and equipment (supplying potable water, draining, water retentions and hydro-agricultural areas, pastoral hydraulic, electrical and sanitation equipment, roads etc.). The totality of these lacks engenders negative consequences and increases the poverty of these populations.

Because of this paradoxical situation characterized by the availability of social resources on the one hand and the poverty of the population on the other, we can conclude that the exploitation of the basin resources is not carried out adequately in order to improve the livelihood of the basin's population.

Many of the economic activities carried out in the basin depend directly on the exploitation of natural resources (water, land, fauna and flora). Besides the hydraulic managements and works, these activities (agricultural, pastoral and mining in particular) are practiced in an extensive or traditional way. Thus, the rural economy remains mainly tributary to the environment. The forests are being cleared at a faster rate than that of natural regeneration. The degraded environment offers fewer resources to the poor, a population that is constantly increasing.

The consequences of an unbalanced economy and a degraded economy are equally visible through:

- the rural population is attracted by the cities which lead to settlements in peripheral and marginal areas and the adoption of an urban mode of living, an urbanized living style based essentially on resources of the rural zone;
- a growth of the urban population and higher demand for energy usually met by using wood and coal which contributes to the degradation of the vegetation cover and the erosion of the soil in the exploited zones.

The revenues of these countries come essentially from either a market economy (oil, uranium, cacao, coffee, cotton) and subject to the fluctuations of international markets or a primary economy based on the cultivation of cereals and low added value traditional activities.

Taking into consideration what has been mentioned above; fighting against poverty is becoming an obligation in all the IAS basin countries.

In this unfavourable economic context, we can note that the presence of many inter-governmental organizations (UEMOA, CEDEAO, CEEAC, CILSS, ABN, ALG, CEMAC) and the recent initiative by NEPAD express the will of the countries to achieve political integration of development guaranteeing a harmonious and sustainable development.

II.2.2. Education

The basin portion disposes of an important number of educational institutions: pre-school, primary, secondary and higher as well as technical and vocational schools.

The rate of pre-school enrolment is very low but has improved mainly thanks to setting up community kindergartens in the rural areas.

Demographic growth with the age bracket of children at kindergarten education age requires important efforts from authorities. Pre-school education remains an urban phenomenon with an important participation of the private sector.

Basic emerging or primary education has witnessed significant progress during the period 2000-2006, namely in terms of access and coverage. This performance is the result of an important mobilization of all the system's stakeholders which has materialized in the form of massive recruitment of new enrolments in first year.

In terms of education quality, the levels of the indicators remain low but are witnessing a sure progressive evolution. At the level of secondary education, the situation is almost similar to tat of the primary education. The universities, the technical and vocational schools are developing at a slow pace.

II.2.3. Health

The situation of health in the IAS basin as a social sector is equally considered from the infrastructure and equipment perspective. It is characterized by a low coverage rate, low rate of access to basic social services and low social indicators. Generally speaking, the coverage in terms of health infrastructure and equipments is characterized by its low rate on the one hand and the uneven distribution of health centres. The staff available does not equally cover the need and there are important disparities between the cities and the other parts of the countries.

The situation of health services is characterized by the persistence of diseases and particularly those of water origin as well as the common use of traditional medicine and the "soil pharmacy". It shows equally the importance attributed to health through mainly increasing allocated budgets and national health policies.

Evolution during the last few years has been characterized by the implementation of reforms aimed at the improvement of infrastructure and health indicators. These reforms, for some, have already allowed the growth of the coverage rate in terms of infrastructure and personnel. The evolution of the last few years has equally been marked by the emergence of private structures and the mobilization of technical and financial partners to fight some diseases namely HIV/AIDS, malaria and poliomyelitis.

To back up this growth, setting up a decentralization process, the existence of projects and programmes in the field of health and opening the health sector activities to the private sector seem as important assets.

Besides these assets, the centralized management of resources, the persistence of endemics, the remoteness of certain zones, and the low rate of people using the health centres as well as limited access to health services are real constraints. Faced with these constraints, favouring complementarily between traditional and modern medicine and realizing the objective "**health for all in 2025**" are important obstacles to overcome.

II.2.4. Supplying potable water and drainage

Supplying potable water is carried out using extraction works (wells and drillings) and water distribution systems. In the rural areas, supplying potable water is carried out using wells and drills often set up within village hydraulic programmes. In urban, areas, supplying water is carried out through complete supply networks run by companies or offices.

Access to potable water differs from one country to another. In Nigeria, this rate was in 2000 is 26% in rural areas and 63% in urban areas.

The situation in this domain is characterized by a low coverage of potable water supplies. In fact, despite village hydraulic programmes, many basin zones suffer from deficits in modern water points.

The trend noticed in the IAS countries is of a relative improvement in terms of access and consumption and an increase in the number of potable water works. However, the existence of a large number of water points which are out of order, because of lack in maintenance, often reduces in a drastic way the potable water coverage rate. In fact, the rate of out of order works can reach 35% in some countries.

We notice the increasing involvement of the private sector in the management of water points as well as the transfer of controlling works from the state to the local communities and users as well as an increasing responsibility of the populations in the operation and management of water points.

The major strong points in the field of AEP concern mainly the existence of policies in the field and the availability of technical and financial partners to accompany governmental efforts. The major changes and trends in the sector of potable water supply are characterized by an important growth in demand for water in the basin by 2025. The situation of drainage in the cities, villages and other communities of the basin remains the subject of concern despite some progress. It is characterized by hygiene problems and the presence of diseases of water origin. Insufficient investments in the field explain the situation partially.

Nowadays, the sector has witnessed certain changes resulting from the joint work of the state, local communities and development partners. Thus the trend will be the increasing consideration of draining in the public investment programmes.

Besides these assets, the limited population's awareness of the importance of drainage and the

impact of diseases of water origin, the limited financial resources allocated by the states to the sector are obstacles to overcome. To this end, increasing the rate of AEP and drainage, improving the existing infrastructure and equipment and better allocation of funds to these infrastructures and equipments seem to b the real challenges.

II.2.5. Socio-economic activities

The socio-economic activities in the basin depend directly on the exploitation of natural resources (water, land, flora, fauna, mining etc.). Besides the managements and hydraulic works, these activities remain mostly practiced in an traditional extensive manner.

▸▸▸ L'agriculture

Agriculture is the development engine in the IAS basin countries. Its contribution, together with that of livestock breeding, to the GDP is 40% and generates 70 to 850% of the receipts from exports. It employs 80 to 90% of the active population. In these countries, the performance of agriculture is highly dependent on rainfall and the environment (water, soil).

Agriculture remains essentially subsistence agriculture of the pluvial type based on the cultivation of cereals (corn, sorghum) with a trend during the last few years of developing market cultivations mainly cotton. The prevailing mode of production is of the extensive type and the tools used are still rudimentary with a low integration of livestock breeding.

The situation of agriculture shows a predominance of pluvial and subsistence farming, an **involvement of women** (gender approach) and an important potential of cultivated lands. .

Another evolution notice the growing contribution of the basin to national production; increase in cultivated areas, the development of new sectors and a tendency to increase cereal production by 2025.

Factors favoring this evolution include the possibilities of improving production systems, the existence of dynamic young human resources and a great potential in cultivated lands and hydraulic.

However, besides these assets, some insufficiencies and irregularities such as rainfall, insufficient control of water resources, low producers' revenues and lack of organization, conflicts between farmers and livestock breeders and the high pressure on cultivated lands are the major agricultural development obstacles in the basin. Faced with these constraints, ensuring the control of water resources, developing a competitive and productive agriculture guaranteeing food security and strengthening the production potential are the major challenges for a sustainable agricultural development in the Niger basin.

▸▸▸ Livestock breeding

Besides agriculture; livestock breeding makes up an essential element of the IAS basin's economy. The situation of livestock breeding is characterized by a varied and relatively important stock, the existence of numerous livestock markets and important transboundary mobility. We equally find an important development of livestock breeding in the basin because of the availability of a better nutrition potentials and better sanitation.

The situation of livestock breeding has revealed the pastoral vocation of the basin and the presence of two types of breeding: the agro-breeders who associate livestock breeding to their farming activities mainly food crops and the transhumant nomads. It is characterized equally by the availability of reliable statistical data. In 1989, we find at the level of the basin: 2,25 million bovine

heads in Mali, 850.000 heads in the Niger and 8,6 million heads in Nigeria.

Generally speaking and for few years, the water supplies programme in the rural areas has privileged supplying the human population. In fact, the new responsibilities resulting from the transfer of responsibilities to the population, mainly in terms of maintenance of the water points they use have been disadvantageous to pastoral hydraulic because of the high mobility of the breeders and their livestock and the absence of real areas of anchorage. Besides, the interest of the hydraulic programmes in drills equipped with man-used pumps has aggravated the situation in the agro-pastoral zone.

The concentration of herds in certain areas has equally been at the origin of a high degradation of natural pasture lands (vegetation cover, bourgoutiere pastures and sylvo-pastoral resources.

We notice during the last ten years, we notice in increasing number of livestock and bovines in particular. The recently introduced governmental reforms and the growing interest in the population of the sector reflect this evolution. IN Mali, the growth rate was higher in the national parts of the basin than in the rest of the country namely for bovine and porcine breeding.

In Niger, the basin zone contained in 2000 68.84% of the national bovine population, 52.56% of the ovine, 58.15% of the caprine and 78.01% of the asins.

Pursuing this trend at the level of these sectors until 2025 may make of the basin a bovine production zone par excellence.

In the basin countries, livestock breeding has become important for the economy. This activity is imposed as an imperative in the quest for food security and to face demographic growth. The assets for the development of livestock breeding are available and they are mainly: the basin's pastoral vocation, the existence of livestock breeding potential, improved and adapted breeds; epizooties control, practicing agro-pastoralism and the availability of fodder cultivation potentials.

However, some obstacles may hinder the development of livestock breeding. They are mainly the absence of control of the population, high dependence against climate change, low livestock sanitation coverage, lack of water resources and the livestock breeding extensive mode.

To this end, ensuring the control of water supplied to livestock, developing the offer in terms of animal fodder, encouraging transboundary movements, managing dirt tracks for the stock and limiting agro-pastoral conflicts remain the major challenges.

▸▸▸ Fisheries

Fishing has an important place in the IAS basin economy. The situation of fishing in the basin is characterized by the presence of a large number of species and three major categories of fishermen: (professional, semi professional and occasional fishermen).

The basin disposes of an important fisheries potential. Fishing is a traditional activity, generally practiced by ethnicities of fishermen. However, with drought and the decreasing flows, this activity seems to become a secondary activity along with agriculture and handicrafts. Fish is often smoked before being sold. The traditional smoking of fish is carried out by women and constitutes an important source of revenue for the poor.

In Mali, the fish caught comes mostly from the inner Delta. Before 1970, the tonnage was estimated at 100.000 tons/yr. This has dropped to 37000 ton / year in 1984-85 (a dry year with minimal flow). The annual average varies between 70.000 t and 90.000 t. In regular hydrological periods, fisheries production has engendered the use of small line nets which has affected the fisheries potential and biodiversity.

Developing fishing has also been hindered by the proliferation of water plants, agricultural and industrial pollution (heavy metals and pesticides).

In the Niger, the fishing sector counts about 10.000 working full time and is the source of living for about 50.000 people. It contributed 1 billion FCFA to the GDP. From 2001 to 2003, this contribution totalled 20 billion FCFA.

The increase in fishing production in these countries engendered drops in imports and an increasing satisfaction of demand with national produce. In 2001, Nigeria spent 47 billion Naira on fish imports. The country's demand is estimated at 1.5 million tons in 2002. The forces backing up this trend are:

- the increasing production and the use of new technologies for the conservation of fish,
- the existence of commercialization networks,
- governmental supports to the efforts of the stakeholders and
- the existence of an important potential (water courses, lakes, swamps etc.).

The development of fishing could be hindered by various obstacles:

- the low rainfall and the extinction of some species;
- the lack of follow up to the fisheries resources;
- insufficient or bad quality of fishing equipments;
- insufficient financial means and fishing capacities;
- difficulties related to commercialization.

To overcome these obstacles, the consolidation of capacities and the stakeholders' means, the development of commercialization, the organization of fishermen and the protection of the fisheries potential are the challenges.

Forestry

The situation of forestry is characterized by the existence of a variety of vegetation (steppes, bush savannahs and forested, clear forests and gallery forests, etc.) as well as projects for the protection of the environment. It is equally characterized by the existence of legislative framework and the judicial tools for the protection of the environment (policies and strategies, environment code, forestry code etc.).

On the economic level, the forestry sector's contribution to improving living conditions and economic growth is felt. However, the management of the basin's vegetation resources is subject to pressure caused by human activity which has accelerated the degradation of the vegetation cover and woody plants. The main forest exploitation is the abusive felling of trees for energy needs, coal and lumber. 80 to 90% of the households all over the country use wood for kitchen needs.

Recurring droughts, the high rate of demographic growth and inadequate management of forestry resources are at the origin of the degradation of the vegetation resources. **In Niger**, about **338.180 ha** are **yearly deduced from the global area of forests** because of the climate and human activities. With this pace, it is expected that the area of forests will be reduced by **1.325.150 ha by 2025** if mitigation efforts are not made and implemented to curve this trend.

Under the impact of poverty and climate change, there is during the last few years a degradation of the vegetation resources in the IAS basin. Because of this situation, one of the major forces is the existence of programmes for the production of reforestation plants along with an important potential in forestry resources and projects for environment project programmes.

The pressure to which these resources are subjected, the persistence of destructive practices (forest fires and illegal occupation of protected forests), the persistence of drought remain the major constraints in the region. **The regeneration of forests** and reforestation are **the major challenges**.

▸▸▸ Transport

The situation of transport indicates the existence of different modes of transport in the basin (roads, air, fluvial and railways). It is equally characterized equally by the sector's crucial role in the basin's countries' economies and by the real development opportunities particularly the fluvial and road transport possibilities because of the increasing involvement of the informal and private sectors.

The basin area is therefore very isolated. In fact, among the different existing modes of transport, road transport remains the most important and most used. Despite these facts, it remains—like all other modes of transport—not developed and does not help bring the region out of isolation. However, change and trends during the last few years show a positive evolution of in the sector reflected mainly in the construction of roads (paved and dirt tracks) as well as the improvement of the vehicles' infrastructure and equipment. The existence of road axes (national and international) as well as potential for the development of transport and the governments' will to develop the sector with the support of partners is important assets.

As far as the setbacks are concerned, we notice the insufficient and limited maintenance of infrastructure and equipment as well as irregular water plans of the river's flow. Because of these constraints, the rehabilitation and development of transport infrastructure and equipment as well as the realization of regulation works for the river seem to be the major challenges.

▸▸▸ Ecotourism

Despite the basin's potential, tourism in the region is little developed outside the traditional tourist areas such as Dogon, Tombouctou and Djenné in Mali. The development of tourism suffers generally from insufficient hotel infrastructure, communication, transport and the absence of initiative policies for tourism in general and ecotourism in particular.

Fauna and hunting are increasingly the major activities of the population and contribute considerable to the basin countries' economies. The fauna species found in the basin differ according to the climate zones. Can be found ostriches, gazelles, hyena, leopards, elephants, lions, hippopotamuses, bubals, wild boars etc. Some protected areas have been managed. There are national parks, fauna reserves, rural life zones (village). The valorisation of fauna resources is increasingly carried out in collaboration with the populations.

Efforts are being made by the countries to organize hunting in order to meet the needs of the various stakeholder categories: the state, the local populations and the concessionaries.

The basin has many important reserves and parks and sight seeing could develop. Among the important sites we find the inner Delta and the parks.

In terms of change, there is fear that the intensification of activities in the basin namely agricultural, energy and mining activities and tourism development engender the degradation of the environment.

This trend could be sharpened by the perspective of a demographic growth rate that remains high and all the consequences this lay have on the water resources and the environment.

The development of ecotourism can find support in the following advantages:

- the existence of varied and attractive rural environment as well as a rich cultural patrimony;
- the availability of structures in charge of ecotourism and a political willingness to develop the sector.

Obstacles include the insufficient and unreliable data, the weak organization of the sector and the limited involvement of the private sector, the limited support infrastructure (transport, telecom and hotels).

To overcome these obstacles, identifying and promoting potentials, providing support to the population in the valorisation of the cultural patrimony, strengthening stakeholders' capacities, ensuring participative management of the resources seem to be the major challenges.

Mining

Mining is often traditional and is at the origin of important environmental damage (holes left open, destruction of vegetation cover, derivation of water courses, pollution etc.). The sale of exploitation licences is accompanied by important risks affecting surface and ground waters with dangerous matter. However, near the urban centres, extraction of sand and other useful substances for building construction using heavy engines and tracks is causing the erosion of rivers and river banks.

As far as gold is concerned, exploitation is mainly traditional with a high intensity of labour is in some areas at the origin of erosion and pollution. Generally speaking, water consumption in the mining activities is not very swell known but remains important. This shows that the development of the sector in the IAS basin must be taken into consideration from the perspective of mobilizing water resources and paying particular attention mainly in the Sahel countries where water is a major subject of concern. Mining in the basin is characterized by the presence of private operators and the intervention of the state namely in through legal texts related to the protection and promotion of the sector (mining laws).

As far as changes and trend during the last few years are concerned, we notice the states' efforts to promote the sector and favour the exploitation of other mining products (manganese, zinc).

These efforts can be backed up by a varied and rich range of mining resources. However, these perspectives can face obstacles such as:

- the insufficient knowledge of the potential,
- lack of or insufficient environment impact studies,
- limited investments mainly national investments and
- insufficient transport means and energy production, etc.

To overcome such hindrances, the major challenges to overcome will be assessing mining resources and valorising the mining potential while keeping environmental impact under control.

Industries

Industrial activities in the basin are still relatively limited. In a number of cases, they are the source of pollution because of the lack of treatment and control equipment. Industries are found intensively near important urban agglomerations. The major industries censed are brick industry, agro-food industries (milk, slaughter houses, oil presses, soap factories etc), textile industries, tanneries and dye works.

Despite these handicaps, the situation of industrial resources in the basin is characterized by the existence of development potential namely fir agro-food industries. The development of the cultivation of cotton and promoting certain economic activities namely in agriculture, livestock breeding, fisheries would contribute to improving the industrialization level in the basin.

In terms of major change and trends, we can estimate that exploiting the basin resources more tensely will engender an increase in the level of industrialization. Potential for the emergence of an industrial fabric is real and governments, with the help of Financial Partners, showed the will and availability to support industry in the basin.

Weaknesses concern all the obstacles to industrial development in these countries (production high costs, isolation of the countries, fiscal and judicial frameworks that are not very attractive, etc.).

As challenges we identify the development of industrialization and a better control of pollution.

▸▸▸ Trade

Trade activities in the basin are quite intense and involve both the urban and rural populations. These activities are characterized by the predominance of imported or locally manufactured agro-pastoral manufactured goods as well as transboundary trade. The populations' trade activities have a long history and extend beyond their own territories which explain transboundary activities. The trade relations between the neighbouring countries are very important. The international Malanville market is a dynamic element in the transboundary economic exchanges.

A look at the last few years shows a growing demand for products in the basin triggered by the growing population. The scope of trade activities during the last few years has equally been at the origin of the emergence of new traders among whom we find women. This evolution may develop with a more important exploitation of the mining and industrial resources which abound in the basin.

Finally, evolution during the last few years shows a development of exchanges mainly across the borders. This evolution may depend on the natural resources potential and the perspectives of developing transport and the fluvial in particular. The constraints are the predominance of small traders engaged in informal activities and imported manufactured agro-pastoral products.

Faced with these facts, the development of transboundary exchanges supported by a performing transport system seem to be the real challenge.

The sub-sectors using water are made up of a range added value activities that contribute directly to the economy such as agriculture, energy, livestock breeding, fisheries and a number of other activities whose impact on the economy is indirect such as supplying potable water to the populations.

Thus, water is an important capital in the countries' economies. It is shyly exploited by the sectors mentioned above. The contribution of economic activities related to the exploitation of water directly or indirectly to the GDP remains low. Regardless of the sector, the potential is far from being valorised according to its optimum level.

▸▸▸ Communications

The state of communication reflects the interest the states give to this sector. It is characterized by the existence of a number of communication means (telecom, mail, radio and TV broadcasting) as well as the New Technologies of Information and Communication (NTIC). As far as this sector is concerned, we notice the important evolution of these countries especially with the development of mobile phones. The development of the sector is at the expense of the rural area.

The changes and tends notices during the last few years indicate a positive evolution of the telecom sector. Demand for telephones, especially GSM phones, is in constant increase in the IAS basin countries. The increasing requirements for communication (telephone, radio and TV, NTIC) will confirm during the next few years the sector's evolution and the efforts lade by governments through reforms (namely privatization) will ensure satisfying the growing demand in these countries.

Obstacles to development are mainly the low income of the populations, insufficient control of new technologies (NTIC) and the high cost of the communication means. All these obstacles equally contribute to the isolation of the basin.

To face these challenges, improve TV broadcasting and phone coverage, modernize and develop communication equipment and tools, strengthen the stakeholders' capacities and make communication more accessible to the population will be the major challenges.

II.3. Legal and institutional framework for the exploitation of water resources in the IAS basin three countries

Water is one of the most important resources in the Iullemeden Aquifer System (IAS) and is faced with three major risks developed in this report with transboundary impact.

Uncontrolled management and excessive exploitation of these resources will inevitably lead to the risk of its diminishing level and degradation. This resource is not boundless. Its excessive and uncontrolled exploitation decreases its availability and affects its quality. In fact, climate change, the predicted growth of exploitation and extraction and the risk of contamination by watercourses may increase the potential of transboundary conflicts thus the need for a participative and consulted management of the risks related to the IAS water resources involving all the stakeholders.

A good sub-regional policy, legal tools (national and a tripartite and sub-regional consultation mechanism) will lead to a participative management of the mentioned transboundary risks.

From the documents of the national consultations carried out within the framework of the FAO Technical Assistance – TCP/RAF/3001 "Developing a Tripartite and Consultation Mechanism for the Management of the IAS" (Mali (Mali, Niger et Nigeria, 2004-2007) and during the drafting workshop of the "**Document on the Policy for the Reduction of Transboundary Risks in the IAS**" (OSS/Tunis March 2008) it is clear that the three countries concerned by the IAS have their own policies and strategies in matters of water management, legislation and a institutional framework for the water. These countries have equally ratified the sub-regional, regional and international accords and conventions within the framework of managing and protecting transboundary and international waters.

In the sub-chapters that follow, we will deal with the legal and institutional framework for the management of water resources at the national level as well as attempts to set up participative management of the sub-regional water resources transboundary risks in the IAS, the stakeholders and their roles. A mapping of the strategic orientations and recommendations will also be suggested.

II.3.1. Cadre juridique de gestion participative des risques transfrontaliers dans les pays du SAI

The three (3) IAS countries have elaborated national water management strategies and policies (Niger, 2001; Mali, 2004, Nigeria 2004 - draft) and signed and/or ratified Accords and Conven-

tions at the sub-regional, regional and international levels. These policy documents have been concretized at the national level by legal texts which take into consideration the participative and sustainable management of water resources and risks through the following major axes:

- improving knowledge of and control of water resources
- improving the coverage of the population's needs in water and their livelihood through the setting up of water points and a programme for the rehabilitation of and maintenance of existing works
- the protection of water resources, the water quality and aquatic ecosystems
- the full participative management of the populations in the conception of and realization of works, improving the management of the works and risks related to water resources, the clarification of and respect of the different partners' roles (Staten communities, Private sectors, benefiting communities) and securing exploitation rights.

Thus, the management of natural resources in general and the water sector, hygiene and drainage in particular are major national concerns reflected in a political will to adopt the legal framework for Mali, Niger and Nigeria. These laws are:

In Mali

- Law N°02-006/ of 31 January 2002 related to the water code in Mali ;
- Law N° 01-020 related to pollution and nuisance, in its general provisions and those related to waste and chemical substances;
- Law N°01-004, of 27 February 2001, being Pastoral Charter in the Republic of Mali in its provisions related to water.
- Ordinances N°00-020/P-RM of 15 march 2000 related to the organisation of potable water supply public services ;
- Ordinance N° 00-027/P-RM of 22 March 2000 with its Domain and Real Estate Code in its provisions related to the State's and territorial communities' public real estate domains ;
- Ordinance N° 99-032/P-RM of 19 August 1999 related to the Mining Code in the Republic of Mali is its general provisions and those related to research and exploitation ;
- Ordinance N°00-21/P-RM of 15 March 2000, related to the creation of water and electricity regulation commission;
- Decree N°01-395/P-RM of 06 September 2001, fixing the modalities for the management of used waters and muck ;
- Decree N°03-594/P-RM of 31 December 2003, related to environmental impact study;
- Decree N°99-189/P-RM of 05 July 1999, instituting of procedures for environmental impact studies.

In Niger

- Law N°98-056 of 29 December 1998, related to the Framework for the management of the environment ;
- Ordinance N°93-014 of 2 March 1993, related to the Water Regime in the Niger, modified and completed by Law N° 098-041 of 7 December 1998 ;
- Ordinance N°93-013 of 2 March 1993, instituting a Public Hygiene Code ;
- Ordinance n°93-015 of 2 March 1993, fixing the Rural Code Principal Orientations ;
- Ordinance N°93-016 of 2 March 1993, related to the Mining Code in Niger ;

- Ordinance N°99-044 of 26 October 1999, related to the creation ; organization and operation of a Multi-sector Regulation Authority, modified and completed by Law N° 2005-31 of 1 December 2005, which ahs as objective setting up an independent multi-sector regulation authority « Regulation Authority », to identify the attributions of the Regulation authority and its mode of organization and operation ;
- Decree N°2006-032/PRN/MHE/LCD, of 03 February 2006, related to the creation, attributions, organization and operation of National Water and Drainage Commission (CNE/A).
- Decree N°97-368/PRN/MHE, of 02 October 1997, fixing the application modalities of the Water Regime

In Nigeria

- Decree N°101 of 23 August 1993, related to water resources which has become a law on water resources in Nigeria ;
- Law N°35 de 1987 related to Authorities for the development of fluvial basins.

Globally, these texts concern the water public domain, precise the management modalities and the protection of water resources by fixing the rights and obligations of the state, the territorial communities and the users. They mainly address:

- basic Principles for the Integrated Management of Water Resources;
- the use of water, the creation, modification and use of water works which must be conceived in a way to avoid risks, the modification of and use of hydraulic works which lust be conceived in a way to limit risks to the quality and quantities of water;
- water users and the creation of related associations in order to prevent the management-related risks and better management of the resources in a consulted and just way ;
- the policy for the conservation of water and soil aim at controlling the flow of surface water and to nationalize the different uses in order to minimize risks;
- obligatory pre-project environment impact risks for the implementation of any programme or project with negative impacts on the environment, natural resources and people and in which all the concerned parties will be fully involved;
- the territory management plans and policies in order to organize harmonious development of the territory and regulate participative management of lands and waters in the national and transboundary territory;
- developing an Information-Education Communication strategy (IEC) in the field of hygiene and drainage where the water users are at the national and border levels;
- regulation and development of natural resources stipulating among other things that the water resources management stakeholders have the duty to maintain and protect water points as well as ground water sheets within the framework of a participative and sustainable management;
- the duty of all water users to take common rigorous measures for the management of hydraulic works and to contribute jointly to the sustainable maintenance of hydraulic works and infrastructure;
- control of tapping and uses;
- control of water quality;
- control of land use;
- defining protected : areas of protection;

- compulsory principle of authorisation and the use of hydraulic works;
- adopting “the water planning principle”;
- adopting “the prevention principle”;
- adopting “the polluter-payer principle”;
- adopting “the responsibility principle”:
- adopting “the principle of water management by Management Unit, by basin or sub-basin”.

II.3.2. Institutional framework for the participative management of transboundary risks in the IAS countries

The institutional framework is both the set of rules established in order to meet collective water interests and the totality of the institutions created to maintain and implement these rules and meets these interests within a participative management framework.

Besides ministerial departments in charge of hydraulic matters (water resources) in the three countries of the IAS, institutions have been created by law and decisions according to the different cases for the management of water resources at the national, regional and local levels. These institutions or consultation bodies are responsible for giving opinions and making propositions related to the management of water and projects and all the risks related to them. They, according to the various cases, are dubbed:

- National Water and Drainage Commission (CNEA);
- Multisector Regulation Authority (ARM);
- National Water Committee;
- Regional and Local Water Councils;
- National Plannjing Cell for the Coordination of the Basin Development;
- Water Development Fund;
- The Water and Drainage Sector Coordination Committee (CCSEA);
- Water, Hygiene Police;
- Water Management Unit (UGE);
- National Environment Council for Sustainable Development (CNEDD);
- Higher Public Hygiene Council (CSHP);
- National Territory Management Committee (CNAT);
- National Housing and Urbanisation Commission (CNUH);
- Real Estate Commissions.

They may also be found in the form of NGOs, Associations, local committees for the management of natural resources and the private sector operating in the field, technical and financial partners...

In terms of managing shared water resources, we find the following international, sub-regional and regional Accords and Conventions which should make up reference:

- the Helsinki 1992 Convention and the New-York 1997 Convention which exclude aquifers from their field of application do not bind any of the three (03) IAS countries because they have not adhered or ratified them;
- the three (3) Post-Rio Conventions, of which the three (03) concerned countries are part

namely : i) the Framework Convention on Climate Change; ii) The Convention on the Environment and Development and iii) the Convention Biodiversity;

- the Convention between Mali, Mauritania and Senegal related to the legal status of the common works signed on December 21, 1978 in Bamako;
- the Niger 2025 Shared Vision, backed up by the Basin Sustainable Development Action Plan (PADD), approved in 2007, is a strategic document which defines and orients the process of integrated development in the Niger Basin Authority –NBA) member countries;
- the MOU between Niger and Mali relating to cooperation related to water resources in the Niger River in the common section of the countries Niger and Mali (July 12, 1988);
- the MOU between Niger and Nigeria (within the framework of the Niger-Nigeria Joint Cooperation Commission), related to equitable sharing and the conservation of water resources particularly the water resources of the Maggia/Lamido, Gada/Goulbi of Maradi, Tagwai/El-Fadama and Komadougou-Yobé basins (1990, 1998);
- the Niger Basin Authority;
- the Niger-Nigeria Joint Cooperation Commission (CMNN);
- the Lake Chad Commission (CBLT);
- the Liptako Gourma Development Commission (ALG).

The Paris Declaration related to share vision for a sustainable development of **the Niger River basin adopted in April 2004** by the Conference of the ABN Leaders can be considered as an international commitment of the involved States in areas of management of shared water resources.

The venue of the Water Charter for the ABN area, whose validation network has already taken place in Niamey (Niger) in February 2008, will naturally favour the consulted management of the IAS water resources.

It is important to note that participative management of risks related to the IAS water resources is not carried out currently by a single institution but rather through national institutions with a shared will to coordinate.

Various levels of collaboration have been implemented involving state departments, NGOs and other institutions as well as water users and their associations in parallel and at various levels of competence.

The role of stakeholders

The role and responsibilities of organizations can be as follows:

- participating in the reflections and exchange of information on participative management of IAS water resources and activities within this framework;
- assuming their share of responsibility in training, communication and awareness in order to minimize transboundary risks related to IAS water resources;
- contributing to the modernization of financial resources;
- contributing to defining the policies and orientations in areas of natural resources management;
- participating in the formulation, implementation, monitoring of transboundary projects and t programmes in the field of water resources.

III. STRATEGIES FOR PARTICIPATIVE MANAGEMENT

III.1. Risks

A complete list of the various risks threatening the basin is in the ADT of the various countries. The risks identified by the countries are fourteen as identified by Mali, 8 in the Niger and 24 in the Nigeria.

Some of these risks are causes or consequences and/or impacts, other transboundary risks concern mainly natural surface resources; it is the case of bio-diversity loss.

The decline in artesianism or the drop in the piezometric levels is the result of extraction and the impact of climate variability and change.

The deforestation phenomenon is one of the causes of climate change that contribute to the greenhouse effect.

The exploitation of water resources is one of the causes of the dropping level of waters.

In the case of studying involving underground water, the loss of biological diversity can be considered as the consequence of a number of factors:

- the degradation of the environment because of human activities (deforestation for example);
- the impact of climate change (recurrent drought);
- the generalized decrease at the level of water sheets engendering the increase of the non-saturated zones then the drying up of the plant roots' zones leading to aridity and then to desertification.

Through this second analysis, the transboundary risks may be considered as major common concerns for the three countries and for which the efforts of one single country will not be able to find a remedy and a sustainable solution. They are of three types:

▶▶▶ **THE DECREASE IN WATER AVAILABILITY:** it concerns the potential modification of groundwaters in terms of (figure 3):

- either increase caused by recharging the aquifers or other sources,
- or the dropping or scarcity of resources.

This decrease can be caused by progressive overexploitation, the reduction of recharge of the aquifers because of:

- dropping rainfall,
- sanding of the water infiltration areas in water courses,
- sanding of the hydrographical network of the Niger River which, at certain areas, supplies the water sheets during periods of high rainfall and ensures its low flow thanks to groundwaters;

▶▶▶ **THE DEGRADATION OF WATER QUALITY:** It is associated with the pollution of water sheets because of waste water disposal methods which do not comply with quality standards and the use of much mineralized groundwaters (fluorides) (figure 4);

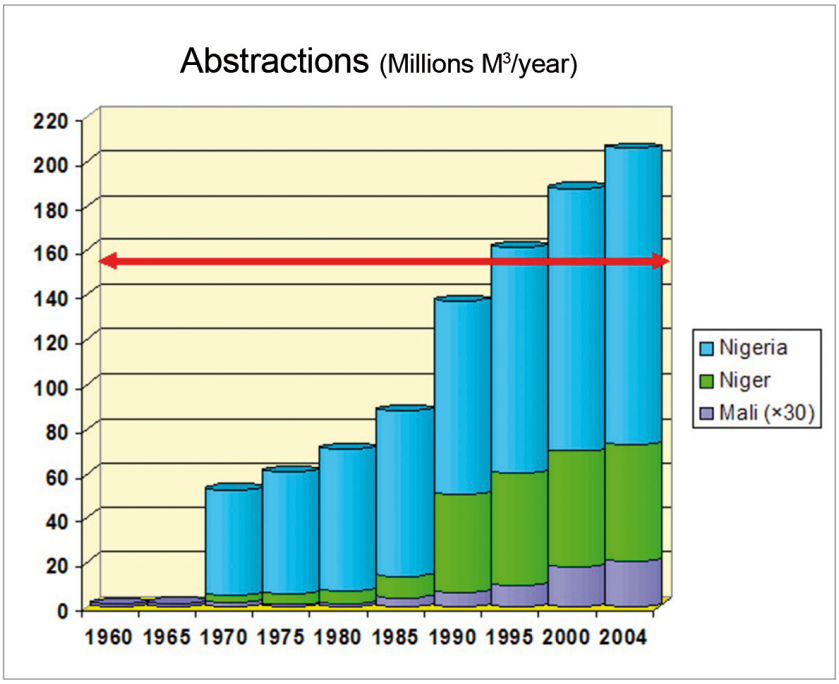


Figure 3 : : over-abstraction threshold was crossed in 1995 according to preliminary estimates. The annual abstractions, estimated at 152 million m^3, which would exceed the recharge is 150 million m^3 per year. These are estimates based on data provided by countries. These data samples are those from flow operating water point (boreholes, well) to the testing date for an operational abstraction of 4 hours per day. These estimates remain to be corroborated by an exhaustive inventory of real water abstractions recovered from the whole water points.

Figure 4: images showing pollution caused by human activities (Niamey in Niger, Onistcha in Nigeria).

▸▸▸ **Climate variability and/or change:** This major concern, often defined as climate variability/change, is particularly both the cause and consequence of situations such as drought.

Climate risk is characterized by its random nature due to the occurrence of climate extremes (droughts, floods) over the next years and decades. Global climate models are further developed for surface water (including rain) than groundwater.

This kind of risk associated with climate variability / change is characterized by 1) the silting of the Niger River system by reducing its groundwater supply from the Continental intercalaire (Ci) and the Continental Terminal (CT) aquifers and promoting floods more and more frequent, 2) the es-

tablishment of sand dunes in the recharge areas and land cover reducing infiltration of rainwater in particular, 3) the development of wetlands by people who migrated from desert areas..

III.2. Issues related to the exploitation of water resources

The issues related to the exploitation of water resources are of the conflict type which could be defined as a situation in which many stakeholders are in a disagreement over a given subject and acting according to the perception that the interests of each of them are opposed.

In fact, these different problems are experienced in many of our countries between even the members of the same community as well as in the transboundary zones.

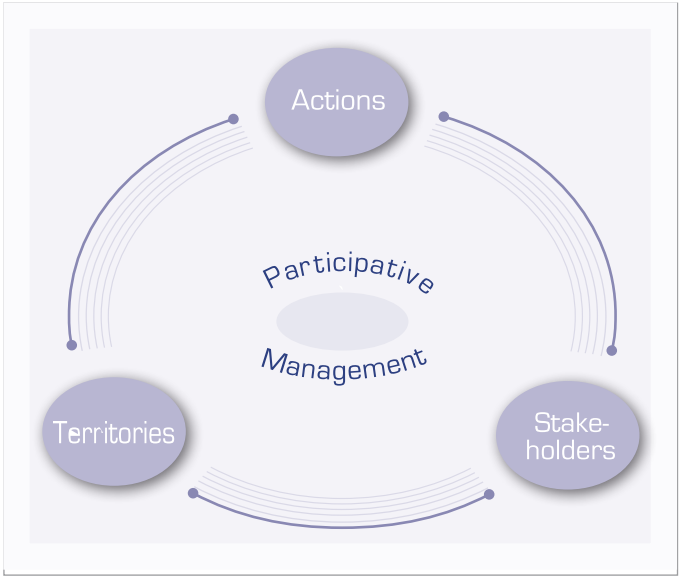
Problems commonly related to the exploitation of water and land resources experienced by the various communities in Mali, Niger and Nigeria are generally similar and could be summed up as follows:

- conflicts related to the exploitation of lands: these conflicts are found regularly in the three countries mainly in the field activities such as the inheritance of lands
- conflicts between farmers and livestock breeders which are common and found in the three countries during the harvest time when grazing is scarce and cattle would eat crops despite the availability of passage paths defined and delimited in consultation with the stakeholders as the cattle breeders fail sometimes to control their animals.
- conflicts related to the exploitation of modern water points (pastoral wells, boreholes, Mini-water supply stations, pastoral pumping stations, dams) shared by the different communities.
- conflicts between the intervening parties (NGOs, projects, programmes, AUE)
- operation conflicts related to the location of the operators. Sometimes those downstream see that as a threat to their interest mainly by the attitude and behaviour of those upstream.

III.3. Concepts of participative management and awareness-building

III.3.1. The concept of participative management

Participative management is involving all the stakeholders in a sector policy. This implies setting up a consultation framework involving the stakeholders of a given sector (such as the case of the management of water and land resources) aimed at finding solutions in the case of problems, risks and situations that may threaten directly or directly the existence of resources or the sector itself.



In the context of this consultation, participative management will be the ideal tool for the **stakeholders** that would allow them to undertake **actions** in order to prevent the various Iullemeden basin priority risks (**Territories**).

As mentioned above, participative management is a consultation framework set up by the stakeholders to solve problems or risks threatening these resources. The

IAS basin is facing hydrogeological risks related essentially **to the decrease of water resources in the basin, the degradation of the quality of these water resources and the impacts caused by climate change and variability**.

Each of the countries sharing this basin has a shared vision of the water resources policy. However, taking into consideration the mentioned priority risks to which the basin is exposed, participative management will allow these countries to focus on the same issues in order to set up a permanent consultation framework that would help finding solutions to these 3 major risks through programmes or strategies in the short, medium and long terms.

III.3.2. The concept of awareness-building

By awareness-building is meant any process using tools to disseminate information in order to educate or warn a group or population about a defined situation.

To pass information or to sensitize, communication tools are used in order to ensure the apprehension of the message smoothly.

In fact, we propose awareness-building tools that seem most appropriate and better adapted to the national realities of the three countries sharing the IAS.

These tools are:

- posters and brochures as well as other publications targeting the large public;
- radio and/or TV spots or any other means of information (griots, traditional voice announcers);
- TV and radio broadcast round table discussions, recurrent loud and flashy media coverage which would help keep the large public informed on the risks threatening the IAS basin and action undertaken or to be undertaken;
- information meetings on chosen days. National reflection and information workshops on risks related to the harmful practices in the exploitation of natural resources or public meetings where the population is informed in a clear accessible language they understand (this means using their language and level of accessibility). They equally must be heard;
- reflection networks to allow more direct exchanges between the scientists, the administration and the large public;
- sketches and plays to broadcast on the community private and public radio stations ; private and public TV channels;
- building up national capacities favouring information and scientific exchanges at the national and sub-regional levels;
- exhibitions on the basin activities focused on the environment and the various products;
- open doors days;
- demonstration fairs;
- road cinema to broadcast films and documentaries.

To help make the information accessible to all the stakeholders, the IAS hydro-geological risks management project have equally seek to involve the competence of NGOs operating in the field of water and media and communication specialists. The latter are required to use the appropriate tools according to their goals.

However, as people find in all communities, there are more or less formal spaces for the exchange of information (markets, chat away –"arbre à palabre"-, poster areas, village meetings, local associations, community radios, etc.). These channels were requested in order to disseminate information within awareness-building endeavours.

The following table gives an idea on the communication channels which can be used according to the target public.

Communication tools	Tasks/Pertinence	Target public
National/private radio stations	Information, Education, Entertainment	All types of public
Rural/regional radio stations	• Community speech tribunes, • Exchange of information, ideas and technical know how in areas of environment and natural resources management	Urban and rural communities, technicians and development workers, local elected political representatives, NGO/OCB
Rural community radio stations	• Promoting development, • Collect the expectations and solutions proposed by the populations, • Disseminate information and knowledge	Village and remote areas dwellers, local politicians, OCB
National and private TV stations	Inform, educate, collect opinions	Inhabitants of urban zones
Newspapers	Inform, explain, analyse the river's and basin's environmental situation	Literate public
Visits and exhibitions	Inform, sensitize, mobilise, exchange	All types of public
Meetings/consultations	Inform, exchange, coordinate action	Stakeholders of various levels
Plays, films, sketches, songs	Promote dialogue, simulate exchange of practices, facilitate the presentation of objectives and challenges	All types of public
New Information and Communication Technologies (NICT)	Provide new communication possibilities, transmission of data, report experiences and research, transfer of technologies, etc.	Decision makers, researchers, developers and development workers
Education Training and Research Centres	Educate, transmit knowledge of good and bad practices, research improvements for these practices in the management of natural resources	Pupils, students, teachers and researchers

Table 2: Some communication tools according to the target population.

III.4. Elements of a strategy for the participative management of risks

Based on the process of the participative management of hydro-geological risks, we can carry out some preliminary planning in relation to the question of how to better involve the various stakeholders of the three States. Involving the stakeholders shall be carried out as follows:

- interests, importance, influence of each of the stakeholders;
- particular efforts needed to involve the important stakeholders lacking influence;
- the appropriate forms of participation (tableau 3).

It is important to include in this strategy the phases to improve the understanding of the water resources participative management.

The participative management of hydro-geological risks in the basin will require the involvement of all the stakeholders in finding a solution to the three major risks. It will be necessary to analyze each of these stakeholders' level of involvement in the three States. This analysis can be carried out according to the following phases:

- identify the major stakeholders in the multitude of groups and individuals which could potentially affect or be affected by change in the management of hydro-geological risks threatening

	CHARACTERISTICS
Manipulated participation	Participation is simply pretension
Passive Participation	People participate after being informed of what has already been decided or produced. The information shared belongs to external professional sonly ;
Participation through consultation	People participate as consulted or by answering questions. No part is conceded in decision-taking and professionals are not obliged to take into consideration the people's opinions ;
Participation for material incentives	People participate in exchange for food, cash or other material incentives. The autochthonous have no interest in carrying out these practices when the incentives are suspended
Operational Participation	Participation is seen by external agencies as a means to realize the project's objectives, particularly in reducing costs. People may participate by constituting groups to answer predetermined objectives of the project
Interactive Participation	People participate in the common analysis which leads to action plans and to the formation or reinforcement of groups or local institutions which decide how available resources are used. The learning methods are used to collect the multiple points of view
Self-mobilisation	People participate by taking initiatives independently from external institutions. They develop contacts with external institutions for resources and technical support but keep the upper hand on how these resources are used

Source : Dalal-Clayton B, Bass S (2002)

TABLE 3: Différents types de participation

the basin.

- assess the stakeholders' interests and the potential impact of the hydro-geological risk management on these interests
- assess the influence and importance of the identified stakeholders.
- provide a strategy for the stakeholders' participation (a plan to involve the stakeholders) in the different phases of the preparation for the plan.

III.4.1. Elements of the short and medium term programme

In order to elaborate the strategies for participative management, a short and medium term programme must be elaborated in a first phase taking into consideration the three major risks the basin faces.

This programme will focus on identifying the **needs** of the stakeholders' intervening in the three countries, assess their interests and potential impact in the management of hydro-geological risks on these interests and finally assess the influence and **importance** of the identified stakeholders.

▸▸▸ GENERAL STAKEHOLDERS' NEEDS IN EACH OF THE COUNTRIES

After the missions in the countries and meetings with resource people, needs have been identified and synthesized. Thus, among the various group of stakeholders' needs we find:

Technical and state departments:

- sensitizing and informing on micro-project financing opportunities in the water sector namely **climate change, degradation of water quality and decrease of water resources ion the basin**;
- publishing technical files related to the management of hydrogeological risks (CDs, manuals...);

- publishing the appropriate reviews and bulletins (on the environment, lands and water) and on action undertaken by projects, regional programmes;
- publishing manuals or training guides in the field of technical management of natural resources.

NGOs and projects:

- sensitizing and informing on opportunities for the financing of micro-projects;
- publishing the appropriate reviews and bulletins in the field (on the environment, lands and waters) and on the action undertaken by the projects.

Industries, enterprises and companies:

- sensitizing and informing on the sources and consequences of water and land pollution in the basin.

Local producers and operators (Water users' associations, farmers, livestock breeders, fishermen etc.):

- awareness-building among the population on the advantage of common property;
- awareness-building among local politicians on the notion of sustainable development of land and water resources in the basin;
- informing local stakeholders on the consequences of impoverishing lands and water resources in the basin;
- awareness-building of the public (through rural and community radio stations) on the advantages of a rational and sustainable management of natural resources;
- multiplying programmes on the protection of the environment;
- organizing discussions (Exchanges/Discussions) between land and water users', farmers and livestock breeders namely on the prevention of conflicts;
- holding village sessions and projecting films and other documentaries on the experiences in terms of good practices in the management of natural resources;
- awareness-building of the public on the rights and duties in the management of natural resources in the basin;
- vulgarisation in national languages of the legal texts on the basin resources.

Rural communities:

- elaboration of awareness-building and education tools for the stakeholders on the exploitation of the basin resources;
- broadcasting programmes on the question of water in the basin;
- scheduling study trips;
- producing and intensifying meetings, projections and audio-visual broadcasting mainly in local languages.

▸▸▸ Influence and Importance of stakeholders

The population living in the basin

Having survived droughts and other natural disasters and insecurity, the Iullemeden basin populations have acquired the experience of coping with austerity and difficult living conditions. Each time they have been solicited to lend a hand in the realization of collective interest works, they have reacted very positively and have great satisfaction. They have equally proven reliable in cautioning

and arbitration. They have the ability of self-management and self-assessment or at least they have the potential for that.

The development of democracy has helped the populations open up to the exterior world, which they understand better now namely the appreciation and assessment of discourse and the realizations of the government and the administration and to have an opinion and a budding political culture, to have a taste of power in decision taking and negotiation, to build up awareness of their political importance and the distribution of political power. The political campaigns of the various elections have contributed to "opening the eyes of the populations" even though in some cases discourse has tended to favour ethnocentrism and regionalism. Hence, there is at the level of the populations a real potential for receptivity, discussions, dialogue and negotiation.

The myth of the exceptional regime power is dissipating. The populations have developed critical thinking and seize the political authorities about issues of concern to them. We see progressively the populations and the public administration coming closer together. The context is favourable for the population to assume responsibility and participate in base development action. In some IAS countries, decentralization has become a lived reality despite some insufficiencies related to limited action capacities and means. The other countries already engaged in the process of decentralization have experiences from which they can be inspired on the methodological level.

The populations of the IAS countries have learned to live together without major obstacles. They have achieved their economic and social integration without waiting for the governments top ratify treaties and accords. With an improved organization of activities and scrupulous respect of texts and common traditional laws, cohabitation between the different nationalities can be further improved.

Generally speaking, the population pyramid is characterized by the predominance of youth. This faction is dynamic, ambitious and full of potential for change (despite the presence of regressive attitudes among the older generations). These populations have even expressed the wish to participate (during our interviews) in the conception and implementation of projects of interest to them. They haven however, been critical toward projects that have marginalized them and been carried out without or with little participation on their side.

Globally, awareness-building action, information and training in the field of environment carried out by the various projects and programmes have had a positive impact on the populations in terms of building up awareness of the threats the degradation of the natural resources represent. Similarly, the populations have participated in conservation, restoration or protection work involving natural resources (reforestation, recuperation of land, protection of banks, fighting against plant invasion). There is thus some form of "capital". We will not start from a scratch.

Other stakeholders

NGOs have acquired an important experience on the field and some have developed positive partnerships with the populations and Financial Partners. The national NGOs personnel is now initiated to the conception and implementation of development action. International NGOs seem to be better understood and adapted by the population. Among national NGOs (a small number) some have proven efficient in participative management. NGOs remain open to collaboration in the field of environmental projects. With more professional national NGOs, we find structure on which participative and volunteer development action can be based.

As far as Financial Partners are concerned, being convincing and assuring in terms of sustainable development objectives and reduction of poverty is sufficient to gain their support and. We have to acknowledge that past experiences of failed projects through wasting funds, corruption, lack of efficacy and inefficiency have made them increasingly cautious. They now require concrete proof before committing themselves.

Local public authorities and state technical departments are underemployed because of lack of work means. There is potential to redeploy their capacities within the framework of development projects. They are waiting to be associated to the projects. They have openly expressed the need and necessity for that. The decentralization process being set up progressively will facilitate the transfer of decision-making powers and competences to the local level. This will be evidently an advantage.

The traditional Chiefs are increasingly open to collaboration with projects if they are involved taking into consideration some socio-psychological obstacles. It would be advantageous to know the context, sensibilities and latent or hidden internal conflicts that may exist. Involving traditional Chiefs means better chances to mobilize the populations for the project's objectives.

As far as projects underway are concerned, we need to know how to benefit from them. It is always possible to negotiate with their Financial Partners and entrepreneurs, to know their orientations and adaptation or a given articulation with a new environmental and hydraulic project.

There are real opportunities. It is important to know how to benefit from them. They have their own experience of both success and failure. We can learn from them in order to avoid pitfalls. Some projects still have important resources to inject to support the populations. We must equally take into consideration within a global perspective of intra and inter zone equity.

III.4.2. Elements of a long term programme

This programme, one implemented, will be the roadmap for the application of the strategies for a shared vision of hydro geological risks in the IAS and particularly the three risks (decreasing resources, degradation of the water quality and impact of climate variability and change in the IAS).

To remind, the short and mid term programme is focused on the identification of stakeholders who are expected to play an important role in the participative management of risks and their importance in this shared vision.

Once realized the short and mid term programme will allow the long term strategies programmes to detail the guidelines to follow in order to set up the strategies for a participative management of risks.

In fact, the elements of the long-term participative management strategy are mentioned below:

- at the level of base communities, the strong association of organized structures of traditional chiefs and other opinion is indispensable for the mobilization of the populations for a collective leap favouring the good management of resources and the potential risks. This participative involvement must be carried out at various levels : i) identification of problems and needs, ii) fixing priorities, iii) defining measures and actions to be undertaken, iv) implementation of measures and actions, v) monitoring;
- women defend their image and place next to their husbands and within their societies through their work and contribution to their families. They take part in the extraction from nature mainly in terms of wood resources. Their commitment and important participation in the inversion of degradation of the basin water resources trends is certainly without alternative;
- to convince the population and operators to give up activities that are affecting water resources, it is recommended to propose alternative activities and revenue sources; it is not possible to dissuasion or force to make the population renounce activities affecting the water resources. Now that the populations have had "a taste of democracy" they will not hesitate to make the governments give up measures that are not cautioned; to convince women to stop the deforestation activities, alternative energy sources must be adapted to their needs taking

into consideration their level of knowledge and experience. To avoid the exploitation of children and their contribution to the degradation of water resources, they must receive education, be entertained at school in order to stop the destruction of wood (timber), alternative metal or plastic material must be provided at competitive prices;

- it is important to sensitize the population on the consequences of these exploitations of a collective patrimony, on the threats this represents for the near future. They must understand all the degradation mechanisms that affect the water resources and their impact on livelihood;
- the consolidation of the roles of traditional chiefs, opinion leaders and managers of community organizations to make links in the transfer of know-how, the respect of commitments, monitoring, promoting good practices, promoting education on water etc. are essential for the credibility of the project for the management of hydro-geological risks in the IAS which has adopted as principle the full participation of the population;
- the populations do not have rights only. They also have obligations. They must learn to respect laws and rules. It is important therefore to teach the population to respect the laws in force. Good governance must not be limited to officials in charge. It also concerns the population. It is the fruit of partnership and challenge which has its precise rules. If the texts are not adapted, procedures must be undertaken for their modification or abrogation;
- it is essential to institute, through the various real estate and rural codes, water resources property modes which encourage communities to manage the environment adequately and invest in these resources;
- the Iullemeden basin's environmental context requires on the one hand reconciling between livestock breeding and agriculture, and on the other adapting these activities to the requirements of sustainable development. For these reasons, it is important to promote agro-pastoral practices and techniques that reduce extension and improve profitability and productivity. These practices and techniques must be backed up by the adequate financial and material means;
- fishing, hunting and forestry activities must be the subject of specific measures. It is important to stop not only the degradation of resources and the loss of biodiversity but also to set up a productive capital and manage it for sustainability and durability. Developing tourism activities based on these resources may generate jobs and revenues to the local populations and operators;
- favouring a consultation framework between the various categories of intervening parties through the reflection colloquia focused on coherence and coordination of their respective approaches and activities;
- to have a common shared vision of the situation as well as action and measures to be undertaken;
- share roles and intervention or consultation fields;
- avoid partitioning and enhance communication for a better valorisation of achievements;
- open up to the populations and operators in order to ensure their active participation at all levels of intervention taking into consideration their opinions and acting with their consent and accord;
- promote dialogue and synergy between the stakeholders;
- disseminate at large scale the results of actions and measures achieved through the intervention of the various parties;
- at the national levels, the different domains of the water sector must be grouped together within one single portfolio under the administration of one ministry. This would ensure the stability of the personnel and archives, the continuity of policies, the conservation of an admin-

istrative archive and memory, less conflicting and arbitrary working relations and saving on operation costs;

- organisation such as the OSS should support preparations and the implementation of master management plan for the rural areas in the Iullemeden basin with as objective the rational and just use of water resources. An inter-state technical committee can be set up to this end;
- the project for the management of hydro-geological risks in the Iullemeden basin must support the creation and operation of a transboundary joint surveillance brigade for the use of water and forest resources and the respect of laws in force. This structure will fight all forms of illegal and destructive practices in accordance with the legislation and laws in force;
- the partner system must be mature and well-thought, well-prepared and seriously discussed with all the stakeholders. Mainly the firm commitment of the local elected authorities, traditional chiefs, other opinion leaders and state technical departments in the conception, implementation and monitoring of the actions and measures envisaged by the project are of paramount importance. The roles and tasks of each of the stakeholders, each category of stakeholders must be identified with precision and delimited in a transparent and collegial and negotiated way. All these issues must be based on arbitration, control, auditing and assessment system accepted from the start by all the parties;
- contrary to oppressive and repressive approaches for the protection of water resources, the project for the management of hydro-geological risks in the IAS must encourage a pedagogical method based on negotiation, conviction, persuasion and must take into consideration the stakeholders' interests. The local stakeholders must be capable of understanding and measuring the consequences of the degradation of water resources caused by operation activities in case some of their activities must stop to assess the consequences of the water resources degradation caused by their operation activities or if their activities must stop to curve the process of degradation then they must be assisted to find other alternative (tourism, processing local products, intensifying agro-pastoral activities, other);
- stress the measures and actions that facilitate the regional integration, pacific cohabitation between the various nationalities and socio-professional, a shared common vision of the problems related to water resources and envisaged solutions, awareness of the of the easy way of transmitting problems related to water resources from one country to the other ort from one zone to the other through migration; transhumance and the extension of activities.

III.5. Products of risk participative management

The participative management of hydro-geological risks is an efficient shared common for the prevention of risks and problems related to the exploitation of transboundary water resources.

Through this policy of shared vision, the states sharing the Iullemeden basin will be able:

- to set up a consultation framework between the various stakeholders in the water sector involving the three countries sharing the IAS;
- to disseminate information in order to prevent risks and other problems related to exploitation of water and land resources.
- to take into consideration the gender aspect in decision-taking and in the management of water resources.
- to have an integrated water resources management policy.
- to strengthen social cohesion of the various communities living in the basin's transboundary areas.
- to involve all the stakeholders in the management of risk, this may lead to taking a very

informed decision as the stakeholders have all the information that can be valuable to the decision-makers and Financial Partners.

- to set up a consultation framework that can reduce the probability of risks and conflicts which may hinder the implementation of a programme or a policy related to the exploitation of water resources in the basin.
- to involve all the stakeholders who may contribute to the transparency of private and public actions.
- to involve the stakeholders who will be able to develop trust between the government and civil society which may eventually lead to long term collaboration relations.

IV. RECOMMANDATIONS

- strengthen communities' good governance capabilities at the local level while improving their structuring, organization and negotiation skills in order to generate a more important political will on the side of governments and a regional outburst in favor of hydrological risks issues particularly the 3 major risks;
- adopt an integrated approach in terms of solutions, attempts to control issues related to good governance, decentralization and the protection of the basin ecosystem;
- improve people standards of living in accordance with poverty alleviation strategies and MOD;
- improve local organizations performances through the implementation of subcontracted actions and measures and through technical coaching and close supervision;
- with regard to field operations, major intervention axis (water, land, forest, fauna, biodiversity) must be pre-identified and then engage in targeting countries, areas and directly or indirectly beneficiary or involved stakeholders;
- inter-communities synergies and dynamics must be set up in the framework of income generating activities or to reverse ecosystems degradation trends. Stakeholders must have a common fate when facing the major challenges involving the basin risks management. Boundaries and nationalities should be set aside to meet the challenge and give a new impulse to the region.

V. CONCLUSION

The development of strategic elements in connection with the participatory management of IAS transboundary risks, allowed the identification of all the stakeholders involved in the basin as well as their importance in implementing a shared vision policy.

The mobilization of all stakeholders will provide a consensus-building framework including all the parties involved in the water sector in general and in the basin in particular.

The consensus-building framework when implemented will provide solutions to preclude the basin three major risks: **the decrement of IAS water resources, water quality degradation**, and **the impacts of climate changes**, in order to raise awareness among decision-makers, the population and the State about a participatory management approach to IAS hydrological risks.

Social economic, legal and institutional aspects especially those relating to the water resources of the 3 countries have been tackled in detail to clarify different texts in force mainly those dealing with trans-boundary waters.

Besides, the three (3) countries should cooperate in an effective way to achieve a planned resources development and a participatory risks management. This cooperation must be outstanding particularly in the field of trans-boundary shared resources. In accordance with Paris declaration signed in April 2004, member states are bound to cooperate jointly and conversely taking into account previous and new agreements in order to develop and achieve policies, programs and projects in connection with the whole basin or part of it.

The shared vision should be considered as a joint estimate, accepted by all parties, on IAS stakes and challenges especially that IAS is full of important potentials to be used in a concerted, appropriate and sustainable way.

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Iullemeden Aquifer System

Volume IV – Participatory management of transboundary risks

Participatory management of hydrogeological risks is a policy of shared vision very effectively to prevent their negative impacts on the transboundary groundwater resources. It requires the involvement of all stakeholders in finding a sustainable solution in mitigating these impacts.

To achieve this shared vision, elements of a strategy for managing transboundary risks that threaten groundwater of the Iullemeden Aquifer System and a short, medium and long term programme, have been proposed.

The development of these strategic elements identified stakeholders involved in the basin, assessed their degree of awareness for the future of these resources, and their common interest in the establishment of this policy of shared vision.

Taking into account the ongoing environmental actions and measures in the concerned countries and the implementation of water policies in order to mitigate the degradation of natural resources, especially groundwater, tools for managing hydrogeological risks of the Aquifer System have been suggested to increase awareness among stakeholders

- Volume I: Transboundary Diagnostic Analysis
- Volume II: Common database
- Volume III: Hydrogeological Model
- Volume V: Monitoring & Evaluation of transboundary aquifers

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