Information needed to support national sustainable water policies

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1- Introduction

The purpose of this paper is to discuss how to define and organize a national integrated water information system which will bring the relevant statistical knowledge to national policy makers in order to manage their own water resources in a sustainable manner.

2- Water, Information and Sustainable Development

a. Rationale for five pillars within a national water sector information system

According to the Rio declaration (UNCED,1992) three main ideas result from the concept of Sustainable Development.

1) An equilibrium or trade-off has to be found among various economic, social and environmental factors, which contribute to the quality of life of human beings in harmony with nature;

2) However, no sustainable development is possible without the eradication of poverty and the reduction of disparities in standards of living, in particular basic needs in access to safe water and sanitation;

3) Current generations have the right to development but also the duty to pass unto future generations enough stock of social, environmental and economic capitals to give them at least the possibility to gain the same level of quality of life.

Preservation of limited and vulnerable water resources, reduction of inequalities in access to water and sanitation, and integration of economic activities concerned by water, are the first three domains and pillars that a water information system should consider.

In addition, such information system should help Governments improve and measure the process of decision-making so as to achieve the progressive integration of economic, social and environmental issues in the pursuit of development. Water governance is therefore an important fourth pillar to be considered. Finally, time and space issues have to constitute a fifth pillar of this information system because anticipation of impacts is in the interest of current and future generations, and because knowledge of

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variability and spatial distribution of resources and actions are also necessary for proper analysis and management of hydro-systems and infrastructures.

b. Needs in integration, coordination and water resources measurements.

In its 8th chapter, Agenda 21 calls for monitoring and evaluation of the development process systematically, conducting regular reviews of the state of human resources development, of economic as well as social conditions and trends, of the state of the environment and natural resources. It recommends also to establish systems for integrated environmental and economic accounting (IEEA) for a better measurement of the crucial role of the environment as a source of natural capital and as a sink for by-products generated during the production of man-made capital and other human activities.

In chapter 18, it is recognized that the fragmentation of water resources development responsibility among sectoral agencies is proving to be an even greater impediment to promoting integrated water management than had been anticipated. Safe water supplies and environmental sanitation are vital to protect the environment, improving health and alleviating poverty. Therefore, at sub-national and national levels, it is recommended to strengthen sector monitoring and information management for an annual processing, analysis and publication of monitoring results as a sector management tool, with the use of limited sector indicators.

In particular, *water resources assessment* constitutes the practical basis for sustainable management of this vital resource and a prerequisite for evaluation of the possibilities of its development. Such assessment includes the identification of potential sources of freshwater supply. It comprises the continuing determination of sources, extent, dependability and quality of water resources as well as of the human activities that affect those resources. Establishment of national databases is vital to water resources assessment and to mitigation of the effects of floods, droughts, desertification and pollution

Finally, on "information for decision making", Agenda 21 (chapter 40) considers there is need for improved coordination among environmental, demographic, social and developmental data and information activities. Commonly used indicators, such as the gross national product (GNP) and measurements of individual resource or pollution flows, do not provide adequate indications of sustainability. Methods for assessing interactions between different sectoral, environmental, demographic, social and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems.

c. Recent recommendations of CSD-13 (April 2005)

National policy options and practical measures have been recommended by CSD-13 for expediting implementation relating to water and sanitation. In particular, it is recommended *to develop and strengthen national monitoring systems on the quantity, quality and use of surface and groundwater resources at national and local levels, and for measuring progress towards internationally agreed goals and targets, as appropriate, as well as for assessing the impact of climate variability and change on water resources , through the following actions:*

(i) *Establishing and managing water information systems;*
(ii) *Installing networks for monitoring water resources and quality;*
(iii) *Standardizing methodologies and developing monitoring indicators;*
(iv) *Transferring monitoring technologies adaptable to local conditions;*
(v) *Disseminating information to relevant stakeholders.*

d. Role of water in the context of Sustainable Development and MDGs.

The understanding of water's role is important within the context of Sustainable Development (see fig 1). In view of the central role of water in poverty eradication and in securing a basis for sustainable development, progress on water issues will have an important impact on the achievement of several UN Millennium Development Goals and targets. As mentioned during the WEHAB exercise, water has a role as a natural resource, to stimulate sustainable economic and social development by having *improved management and governance structures* in place within the water sector. A second role is that of being a catalyst for sustainable development, helping other sectors achieves their respective goals and targets.

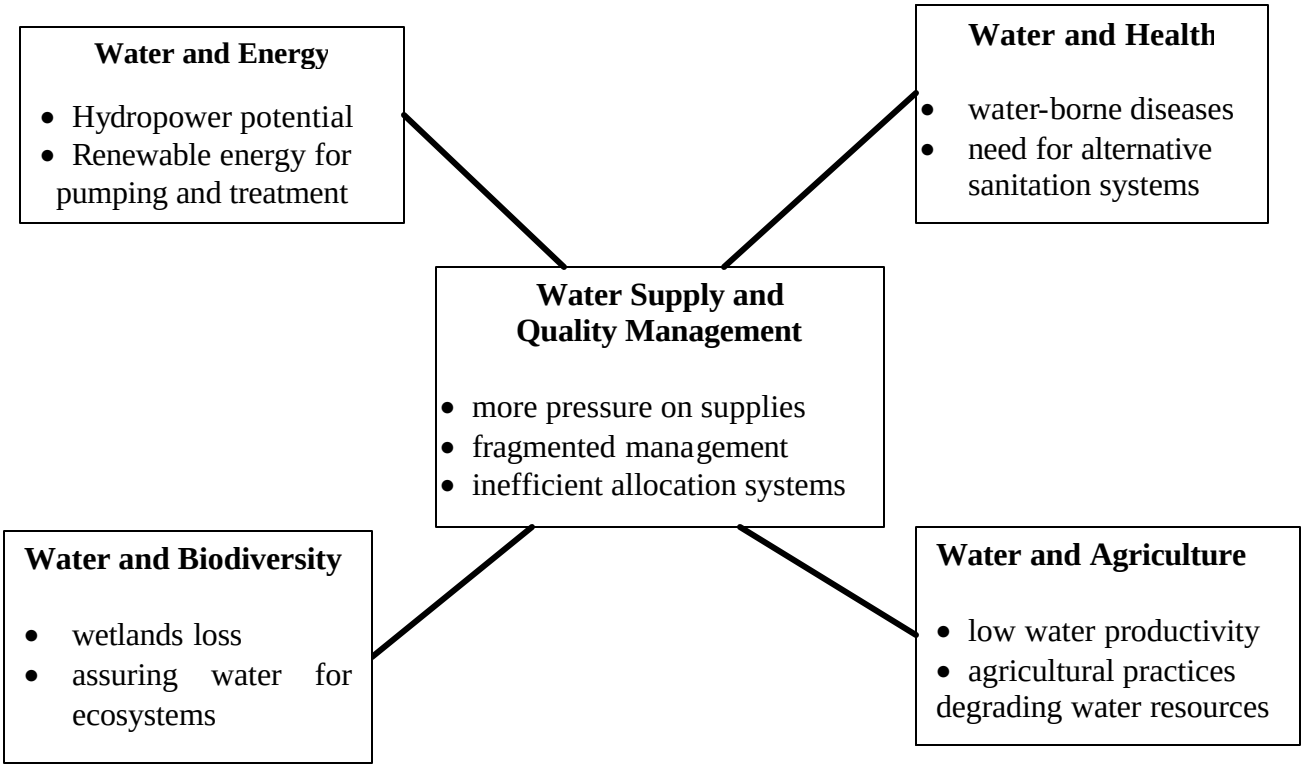


Figure 1: Critical role of water

Source: WEHAB exercise- Aslam Chaudhry – DESA -

For example, addressing and monitoring the connections between water, agriculture and health will make a significant contribution to achieving other MDGs targets. Safe water supply and sanitation, proper nutrition and a safe food supply, unpolluted living conditions, the control of diseases, and access to health services, all contribute to healthy populations. Consequently, poor health is associated with decreased productivity, particularly in the labour-intensive agricultural sector. Development cannot be achieved or sustained when a high proportion of the population is affected by poor health. A clean environment is important to citizens' health and well-being. Unsustainable economic growth can also cause environmental degradation which, together with inappropriate consumption, can adversely influence human health. Finally, achieving these targets will have an impact on the much broader poverty-related aims of halving by 2015 the share of the world living on less than US$1 a day as well as the share suffering from hunger.

3- Information system to support national sustainable water policies

a. Rationale

Changes within water systems are faster and faster. On the basis of sound structured information with dynamic tools, countries need to adapt in real time to new and changing local, basin, national and international pressure on their water resources bases and hydraulic infrastructures. Therefore, public administration often needs to be transformed into a responsive instrument for this purpose. To accomplish this transformation, governments have to innovate their organizational structure, their practices and their capacities. They need to change how they mobilize, deploy and utilize the human, material, information, technological and financial resources.

As the future becomes more difficult to predict and as change occurs faster, there is decreased interest in long-term projections and plans. However, there is still a need for a long- term vision of impact, especially in the water sector where major projects and main reforms take more than ten years to be implemented. It is essential to have an estimate of long-term impact of each current decision: "more a car is running fast, more you need to see far away".

An efficient combination of the two complementary approaches consists in increasing resources towards designing and maintaining an integrated water information monitoring system. This system would be detailed enough, consistent, coherent and robust. It could provide a continuous monitoring of trends of water sector conditions, and in addition it could permit a constant adaptation of scenario modeling in order to estimate, as necessary, long-term impact of current policies.

b. Objectives and benefits of a national integrated water information system

The over reaching objective of a national water information system is to support the national water policy towards sustainable development.

Intermediate objectives are the following :

a) Allow informed debates on policy choices available at any given time;
b) improves ability to detect change and enables rapid change of course corrections;
c) provides a representation of spatial distribution of parameters by aggregation of local data;
d) improves foresight and anticipation with long-term scenario modeling;
e) provides a structured approach for analysis of system status and services performance;
f) facilitates identification of good practices and of less-effective ones;
g) provides a mechanism of reporting to decision makers and of dialogue with Civil Society;

c. Scope of a national integrated water information system

As seen in previous parts, the scope of water-resources management goes far beyond the monitoring of status of water resources and water uses. In addition, because water has to be managed at the local and basin/aquifer levels, priorities are to built information systems with data collected at those levels. Therefore the exercise is not about data requested by international organizations, but about data for direct internal benefits.

Scope of a national integrated water information system covers different levels of spaces; responsibilities and topics :

Responsibilities **Topics**	**Water Sector** (Ministry in charge of water and environment)	**Inter-sectorals, Multi-actors** (other Ministries, administrations and actors…)
Technical Domains	-Water Resources and Uses -Aquatic ecosystems -Rural and urban water supply -Rural and urban sanitation -….	- Macro-economy; Finances - Health - Irrigation and Agriculture - Water and Livestock/Pastures - Hydro-electricity - Fishing - Flood control and risks mitigations
Transversal dimensions and local/basin management	-Implementation of the national water policy -Legal aspects, regulations, enforcement… -Prices, costs and financing -Strategic planning -Information management -IWRM -Quality controle -O&M of hydraulic infrastructures	-Coordination mechanism -Decentralization -River Basin Management -Local operators or associations -Local water governance

Table 1 : Scope of a national water sector

d. Implementation steps of an integrated water information system

A national initiative can be implemented in three steps :

Step 1 : Elaboration of a methodological framework. This framework has to be inclusive of many administrations and Ministries and has to be build upon many existing information systems; data-bases; accounts and GIS. A very high-level political will is often a prerequisite to overcome strong institutional barriers.

The methodological approach has to be driven by the need to integrate the various components and dimensions of the water sector, by optimizing the use of existing efforts and information. This paper proposes below an example of modular structured approach which avoids a juxtaposition of environmental, social and economic dimensions in order to facilitate their integration at the time of analyses for decision aid. However each country has to define its own methodological framework approach, according to its culture, context and own needs. Exchanges or peer-review between countries should be encouraged.

Step 2 : elaboration of a detailed set of descriptors and indicators of the water sector, taking into account the UN framework of integrated water accounts. Those descriptors should be consistent and have clear definitions. Contrary to the previous step 1 referring to specific methodological organization, all countries should adopt the same basic definitions of universal descriptors. Concerning the description of physical and monetary accounts of water resources and uses, it is recommended to use a UN unified glossary for water. Definitions should be derived from existing glossary, as revisited by UNSD for the design of the water account framework and of the questionnaire on environmental indicators. Additional works have to done on definitions of access to water and sanitation infrastructures and services, as well as on the performance of water services (in coordination with on-going ISO works). UN-Water has also began the identification of a set of comprehensive indicators.

Regarding other parameters which have to be defined in the national context, definitions have to be worked out through national working groups involving various administrations and relevant experts and associations.

Step 3 : elaboration of operational procedures .The organization of descriptors collections or measurements must take into account constraints of fragmented localization of basic information, costs and available resources (human and financial). Agreements on exchange of information (on both directions) must be prepared, negociated and signed between administrations, companies and associations. Step 3 should be carried out in parallel with step 2 to verify that all identified descriptors are measurable.

e. Example of a modular architecture for an integrated water sector information system

According to above considerations the architecture of an information system on a national water sector is proposed for discussion (see table 2). It could be organized according to the following five main pillars :

(i) Water sector governance;
(ii) Water resources;
(iii) Access to assets and services;
(iv) Productive activities with water;
(v) Spatial/variability analysis and anticipation.

Five modules have been structured to organize measurement of sector descriptors in order to provide data for sector analysis on Governance, Resources, Equity, Efficiency and Sustainability. Each sector descriptors need to be defined in details, with additional sub-descriptors as appropriate.

A PROPOSED MODULAR ARCHITECTURE FOR A

Table 2 **NATIONAL INTEGRATED WATER SECTOR INFORMATION SYSTEM** desa/dsd/06-2005

	Modules for the water sector follow-up	Proposed descriptors to be measured (-each descriptor needs a detailed description and a methodological approach of measurement, -indicators can be derived, in a second step, from this information)
1	**WATER SECTOR GOVERNANCE**	**Governance** - **mapping of interventions / actors /operators** - **water sector policy and planning** : technical and financial reference tool for all - water users preferences and dissatisfactions - functioning of institutions, law enforcement and participatory mechanisms - local social structuration - public transparency in costs and prices of projects - public monitoring of projects impacts - public inventory and resolution of water conflicts - open consideration and integration of gender aspects
2	**WATER RESOURCES MANAGEMENT**	**Resources** (in physical and monetary terms - proposed format : **disaggregated and expanded water accounts**) • **D**riving forces : socio-economic values (demography; water demands; water production and supply) • **P**ressures : use of the resource and emissions (abstractions; consumptions; waste water…) • **S**tate : water availability and quality (stocks, flows, quality) • **I**mpacts : on economy (depletion of the resources), ecosystem (degradation) and human life(health) • Society **R**esponses : -Management and protection activities : knowledge; human capacities; infrastructures; services. -Changes in process and behaviour : water demand management; recycling; localized irrigation;desal… -Change in use of economic and legal instruments : regulation; taxes; incentives…
3	**ACCESS TO WATER AND ENVIRONMENTAL ASSETS AND SERVICES**	**Equity** - **Access to basic water and sanitation infrastructures and services** - Water allocation between competitive users - Dissymmetry in water information sharing and access - Wide diffusion of education and awareness on water/sanitation/hygiene issues - Ecological dysfunctions - Exposure to risks - **Financing** : users/eco-tax/national budget/external aid
4	**PRODUCTIVE ACTIVITIES LINKED TO WATER**	**Efficiency** - **Water use intensity** - Quality of **operation and maintenance** of existing hydraulic infrastructures - **Performance of water services** including network expansion, **costs and prices.** - Impacts of better population health on production - Impacts of food and livestock production on revenues and health - **Structure of investments and benefits of the water sector** / national investments and productions
5	**SPATIAL DISTRIBUTION VARIABILITY AND ANTICIPATION**	**Sustainability** - **Spatial disparities in repartition of, and access to water supply and sanitation infrastructures** - Capacity in managing upstream/downstream inter dependences within basins - **Ecosystems : consumptions of sensitive resources and lands** (load capacity and density issues) - **Permanent, temporary or seasonal stress or depletion of resource (drought/overexploitation)** - Drought management and reservoirs regulation of highly variable run-off - Scenario modeling of water demand forecasts with simulations of hydro-systems functioning to **anticipate long-term physical and economic impacts of various policy decisions**. - Other disaggregated socio-economic data for indicators (demography; employment; revenues…)

4- Constraints to overcome and operational example

a. Diagnostic

The lack of basic data and statistics, both qualitative and quantitative, is considered as one of the most fundamental challenges to IWRM and to the development of water supply and sanitation. Obstacles forming this challenge include the following. First, information on water resources, water infrastructures and water services is either not available or often scattered in different government agencies and organizations responsible for managing certain aspects related to the water sector (e.g. treatment and distribution of water / inventory and management of water resources / statistical works /…). Second, observation networks have deteriorated in many parts of the world over the past decade and, in most developing countries, databases are inadequate even to characterize the baseline conditions. Third, not only that data collection agencies often suffer from the lack of financial and human resources, poor information sharing among them affects the quality and authenticity of available data for policy planning purposes. Fourth, water resources data is often collected in isolation of other relevant socioeconomic and environmental variables at the basin level, primarily because the hydrological boundaries do not correspond to administrative/political boundaries. Fifth, these issues are further compounded when data are collected and compiled using alternative definitions and classifications across the various data producers, thus rendering the existing datasets incomparable. Finally, increased global reporting requirements but with no visible national benefits caused by too many global initiatives put a further stress on already stretches national capacities and resources.

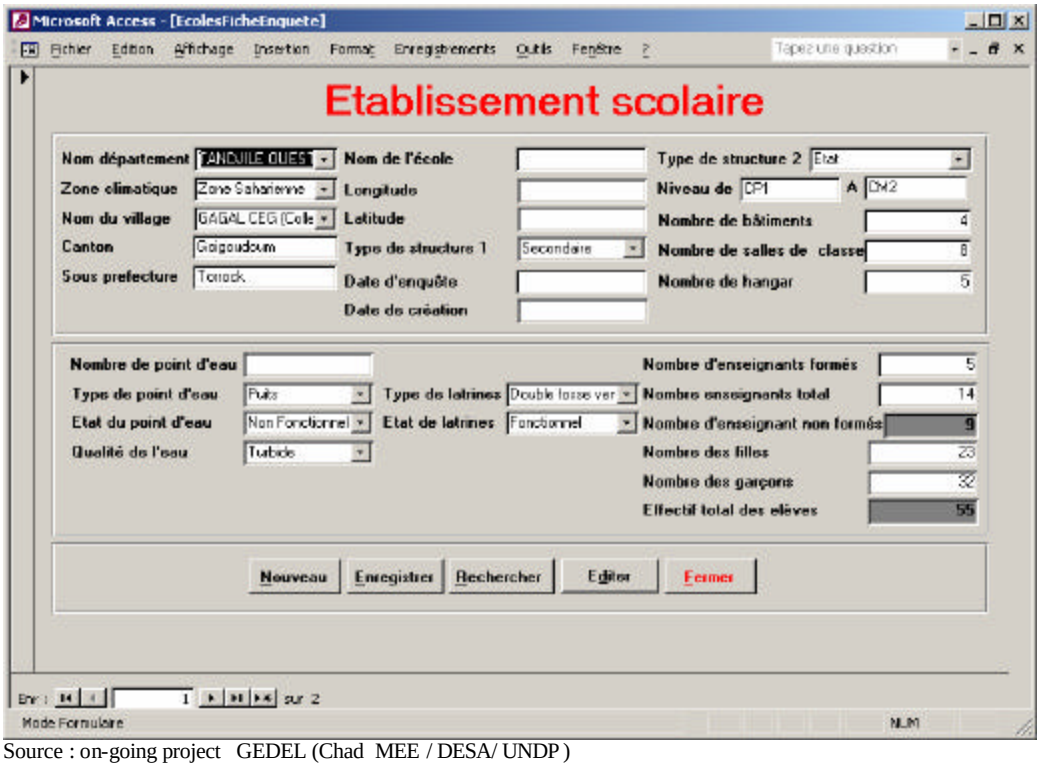
b. Response

IWRM calls for an integrated information system, which brings together reliable information on economic, environment and social issues related to the water sector, including water resources and uses, infrastructures, and performances of services. Such a system will rely on political will as much as it will require an increase in related financial resources, strengthening of human resources and institutions, and better coordination among different data collection agencies and users organizations towards the harmonization of definitions and classifications related to water. International organizations should prioritize and make converge their approaches and supports to national efforts and capacity-building for the effective implementation in each country of a relevant national water information system in support to their own national water policy, which is generally based on internationally recognized principles of equitability, efficiency and sustainability.

c. Example of an on-going DESA-DSD assistance for water sector monitoring in Africa

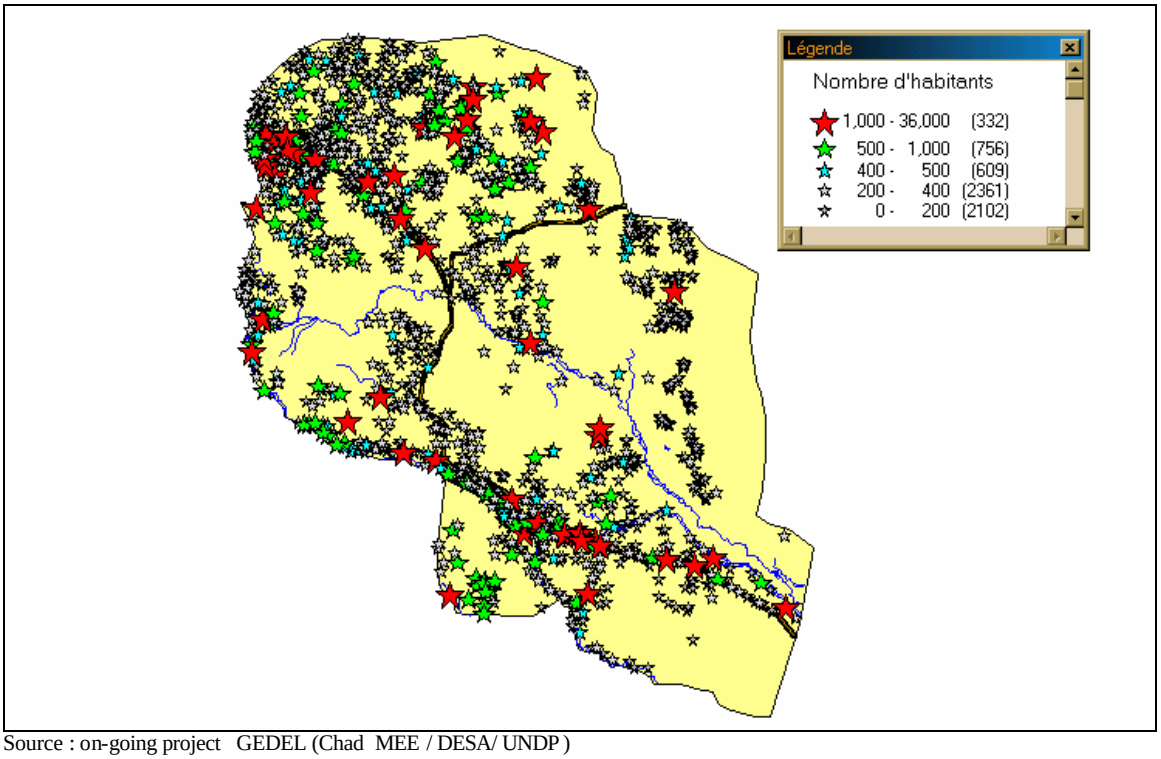
As a follow-up of the implementation of a recently approved water policy, the proposed approach in five modules is currently implemented in Chad (Africa) with the technical assistance of UN-DESA. The central system has been build, with a GIS and data-base, upon existing data within the water administration and outside this administration. Agreement of regular information exchanges have been signed with various other administrations. In addition low cost surveys at village level are going on in one region with the support of local capacities,training and guidelines. Results of this demonstration activity will be presented to the Technical Intersectoral Committee for Water for adjustments and possible replication and institutionalization within a country regular programme of monitoring of the sector.

Surveys, focal points and data computerization (example : inventory of access to water supply and sanitation within schools –data collection on access to sanitation is disaggregated by genre)



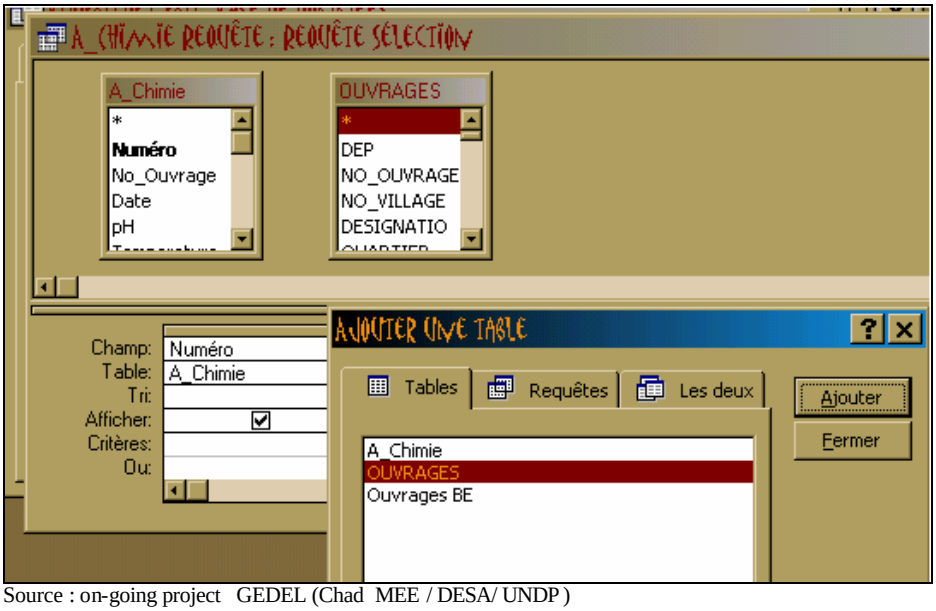
Source : on-going project GEDEL (Chad MEE / DESA/ UNDP)

GPS, digitalization, GIS and classification of basic socio-economic data.
(class of population by village is key for measuring access and optimizing how to fill gaps)



Source : on-going project GEDEL (Chad MEE / DESA/ UNDP)

Spatial analysis of data base on water resources (example : water quality)



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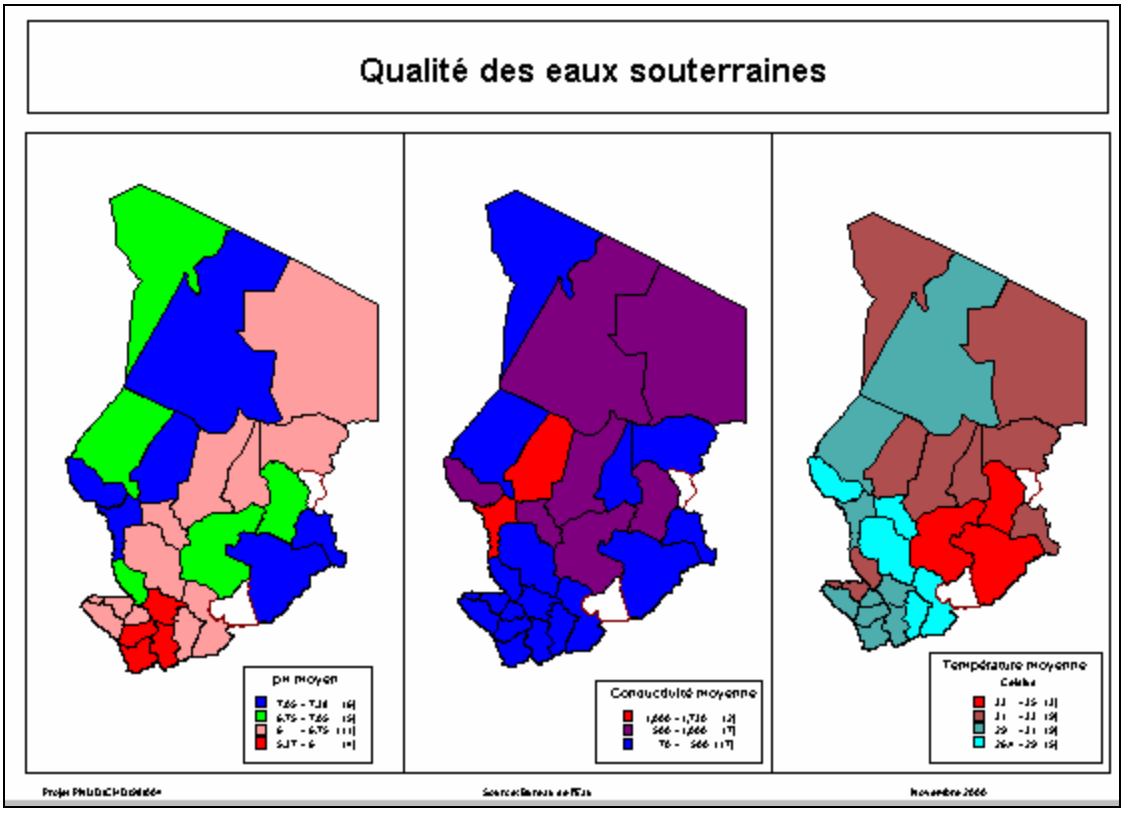
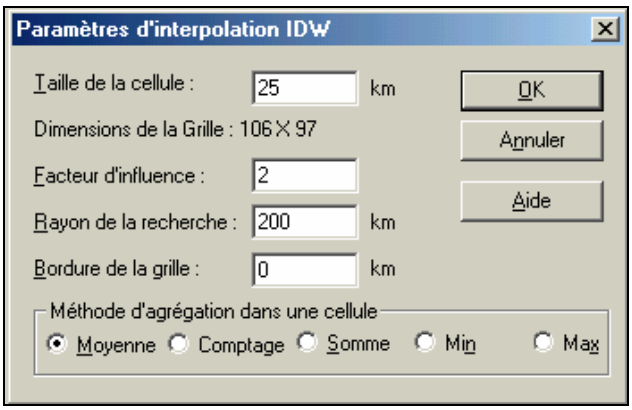
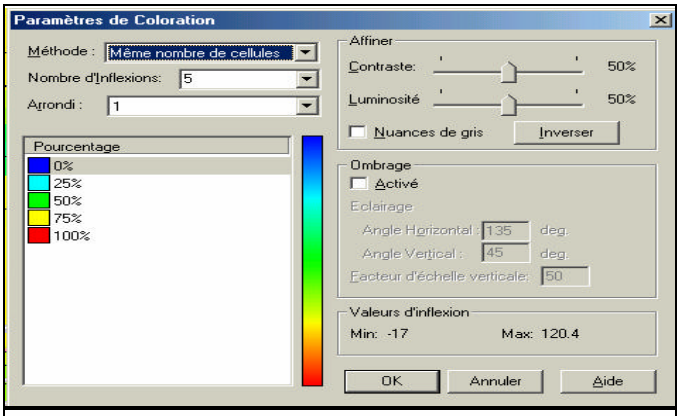


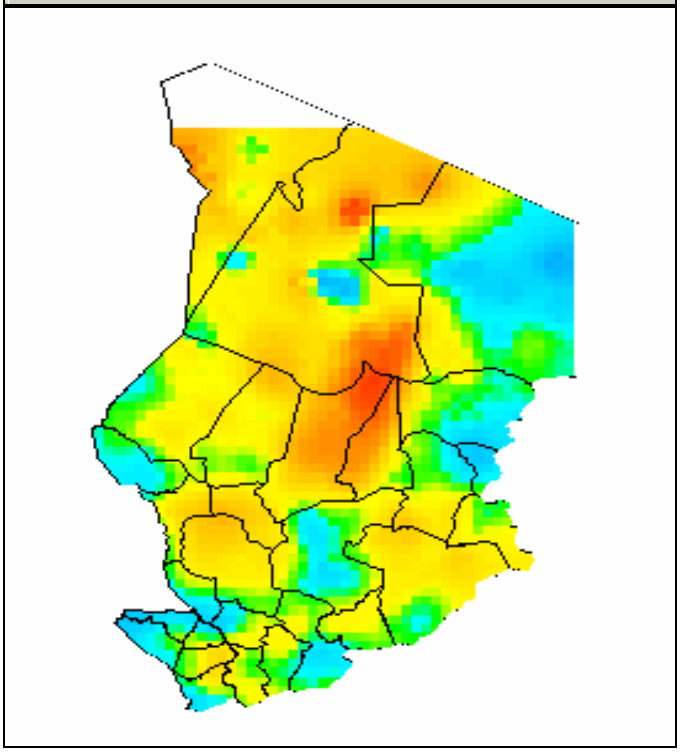
Spatial interpolation



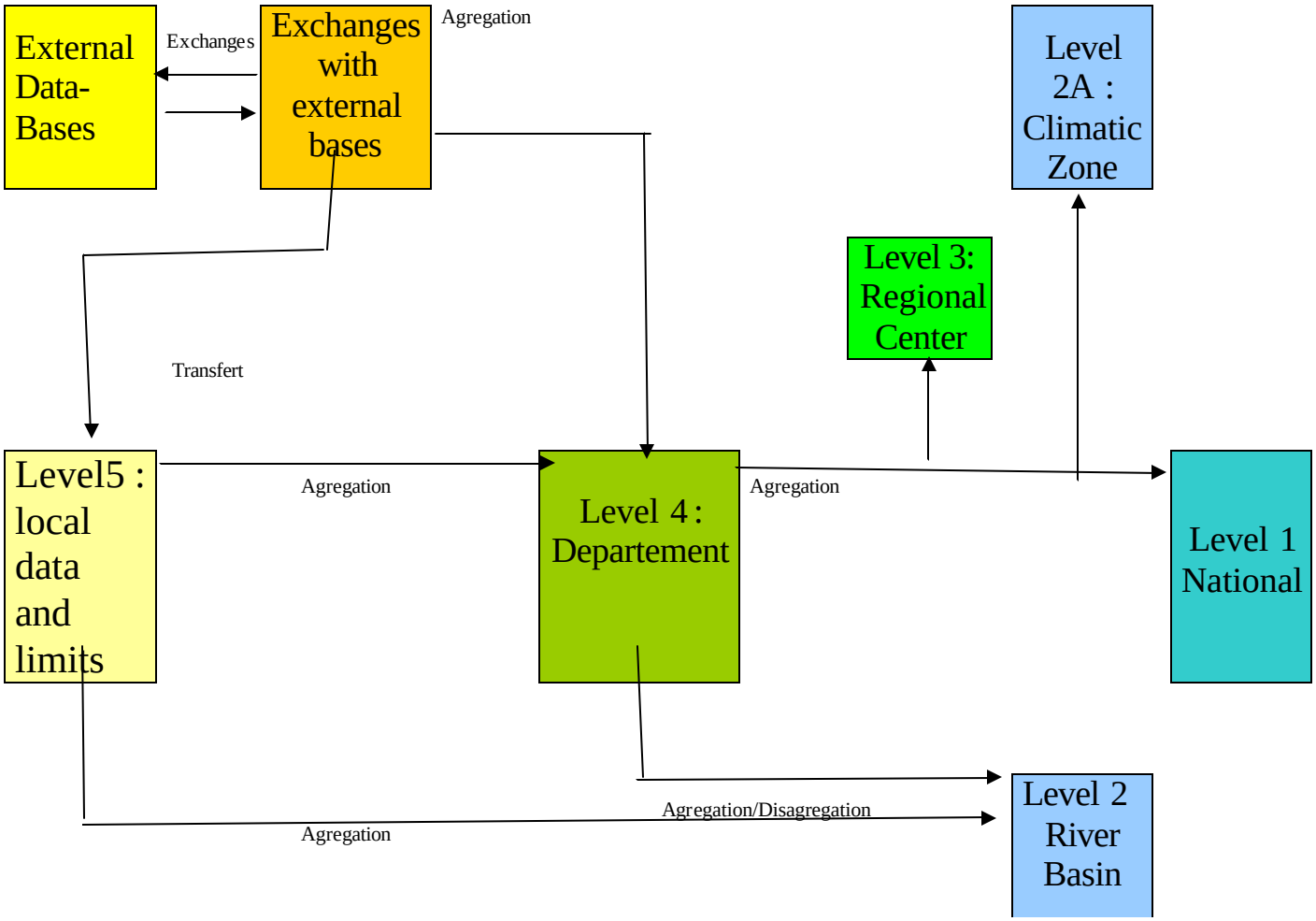


Source : on-going project GEDEL (Chad MEE / DESA/ UNDP)

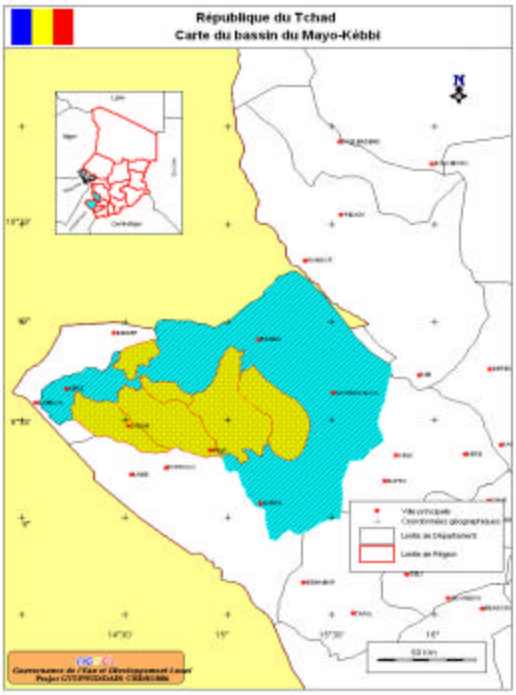
Example : interpolation of static levels of groundwater within thousand of wells. (costs implications)



Aggregation and exchange of data



Dilemna of administrative / basin limits



Source : on-going project GEDEL (Chad MEE / DESA/ UNDP

5- Conclusions and recommendations

Several international water conferences, in particular the UN Commission on Sustainable Development during its 13th session (CSD-13 April 2005), have emphasized the need, at national level, to develop, implement and follow-up on an integrated water policy based on sound information and regular monitoring

The national building of a water information system needs a scientific, multi-disciplinary-systemic approach which integrates, at different scales of geographical analysis : water resources, water uses and return-flows, in quantity and quality, as well as socio-econonomic parameters; population health; productive activities; ecosystem needs and governance considerations.

Integrated water accounts, when disaggregated at the regional/basin level and when expanded to also take into consideration changes in hydraulic infrastructures and in access to basic needs of safe water and sanitation, can constitute when possible, an important part of an integrated water information system.

However, to monitor a national water sector, additional qualitative descriptors need to be defined and measured. According to national specificities they must characterize in particular, progress or decline in: water governance, dissymmetry in information access, water sector efficiency as well as services performance, and sustainability of projects impact.

Effective actions for sustainable water management can mainly be conducted at the local and main river-basin levels within a country. This calls for the collection of data at those levels, with participation of several administrations and contribution of fragmented databases. The use of GIS with disaggregated data becomes a necessity for analyzing spatial disparities. To help anticipate long-term impacts and sustainability of policy decisions, the use of scientific hydro-system modeling and simulation of development scenari can be a necessity.

Therefore, international organizations and donors should give more priority to helping countries willing to develop effectively, over time an integrated national water information system (including disaggregated/integrated water accounts) geared towards an efficient, equitable and sustainable management of their own water sector. With a strong political will, some institutional barriers should then be overcome to implement this multi-sectoral information system through a joint national efforts of water resources specialists, water developers, statisticians, economists, water producers and water operators.

Similarly, the international community of water specialists, water statisticians, environmentalists, and economists should structure their cooperation under a common UN framework (UNSD-UNWAter). According to UNSC and UNCSD-13 recommendations they should mobilize their talents and make converge their experiences in building overtime *a set of common coherent definitions* of realistic descriptors, tables, accounts, indicators and qualitative assessments of the water sector, taking into consideration pressing and specific needs of developing countries. This in turn, would be used by countries for assessing their own progress or decline towards a sustainable and equitable development of their water resources and other water assets. It would also be an incentive for them to share their experience with other countries. On a voluntary basis, those countries could participate in a progressive and coherent global monitoring of progress for CSD follow-up, and other international forum considerations as well.