Defining IWRM indicators via a managerial approach
Case study in West Africa

Jacques Rey (LIV Consulting); Rui Silva, Florence Ardorino (ECOWAS); Hervé Lévite (IPTRID)

Abstract

A gradual return of investors is observed in the water sector (particularly agricultural water). As a result of global policy processes undertaken in the 90's (e.g. CSD process), the investments are often conditioned by the existence of operational IWRM frameworks. West Africa is well advanced on IWRM planning and regional coordination, in particular through the work of the Economic Commission of the West African States (ECOWAS). With a view to improve the operationality of the IWRM concept, the ECOWAS water department (WRCU) is developing a system analysis approach to IWRM.

The approach places a central focus on the interface between the "water resources management" and the "water uses management" and the coordination problems created by the radically different viewpoints carried by the managers operating on both sides of this interface. It emphasizes that the instrumentation of this interface is the key to realistically pursuing the objectives stated in the IWRM definition: social equity, economic efficiency and environmental sustainability. The approach also clearly delineates what is concerning the "performance" of the water systems (in other words whether the above objectives are obtained or not) from the "characteristics of the management systems" embedded in these water systems. Policies, institutions and management instruments are presented as building blocks of such management systems able to confer or not desirable "IWRM characteristics". Based on this approach, work on "IWRM audits" for water management systems can be initiated which will hopefully decrease the perception of water management risks of potential investors. In parallel, cross analysis of performance and management characteristics of various water management systems can pave the way for benchmarking and progress.

The paper proposes a brief description of this operational IWRM approach and draws illustrations from the preliminary work undertaken by ECOWAS, more specifically in Burkina-Faso.

1. Context

1.1. A return of investments?

A gradual return of water related investments is observed, particularly in the field of water for agriculture. This trend may be explained by the renewed political will to solve problems of food security and mitigate risks (climate, urbanization, migrations, conflicts). Hopes regarding the feasibility of developing a yet untapped potential have been distilled in a number of reports [ADB et al, 2007] [World Bank, 2008] and feed into various strategies such as NEPAD proposal to develop 10 millions hectares in 15 years in Africa [NEPAD, 2002], or the 5 millions hectares plan put forward by the Blair C ommission [Lankford, 2005]. These hopes are indeed relayed at the highest level [G8, 2005].
The rate of investments increase is still slow but a number of factors could set the scene for a higher pace. The prices of agricultural products are increasing. Bio fuels appear as a possible substitute for fossil energy triggering interest of private investors. New donors are making their presence felt (e.g. Arab funds, China, Gates foundation). The World Bank is launching its own initiative [World Bank, 2008b].
These efforts are supposed to be developed within the framework of aid harmonization [OCDE, 2005] and respect of good intervention practices. Among the set of generally accepted good practices, Integrated Water Resources Management (IWRM) at national or transboundary level has become an important pre requisite for water related investments and has been widely promoted through a number of capacity building programs.

1.2. IWRM as a pre-requisite

The international consensus created in the 90ties around the IWRM concept was confirmed at the earth summit in Johannesburg [GWP, 2004]. A number of countries engaged in IWRM reform processes; water policies were modified, legislation adapted, new institutions created.
In West Africa, a regional action plan for IWRM was validated and adopted by the Conference of Heads of State and Government of the Economic Community of West African States (ECOWAS) in December 2000. The plan included the establishment of a permanent framework for IWRM coordination and monitoring (PFCM) which was indeed put in place in December 2001 [ECOWAS, 2001]. The PFCM was created to assist the West African States in dealing with the challenges associated with mobilizing and valorizing the water resources

in the region. Its mission is to help the ECOWAS States in defining and pursuing sustainable water management policies. The operational unit of the PFCM was created as a "water department" under the ECOWAS institutional umbrella in 2004 and called Water Resources Coordination Unit (WRCU). A key pillar of WRCU strategic plan consists in setting up a regional water observatory in West Africa [WRCU, 2006].
In the context of defining this observatory, WRCU took on board the criticism expressed towards IWRM in some corners of the scientific community [Jeffrey et al, 2003] and embarked into a process of revisiting the concept with a view to increase its operationality. This article offers a succinct overview of the methodology developed which was founded on a purely managerial approach [Rey et al, 2007]. The "revisited" IWRM framework is presented, followed by some illustrations drawing on indicators calculated using the case of Burkina Faso. Some perspectives for the use of the methodology are presented in conclusion.

2. Towards a managerial approach for the water sector

It is intriguing to note that territories enjoying comparable natural, human and economic potential perform differently in terms of valorization of their water resources. A rigorous investigation of these discrepancies implies characterizing the management of the water sector on these territories and studying the linkages between management and performance for a given context. This attempt requires an operational definition of the "water sector". It also requires a relatively generic representation of the management system allowing a meaningful discussion of its capacity to pilot the performance of the water sector. With the availability of an explicit framework of objectives assigned to the water sector, it then becomes possible to caracterize the capacity of the management system to steer the water sector towards achieving these objectives and design a related set of "management indicators" [Knoepfel et al, 2003].
This "managerial approach" constitutes an appropriate framework for introducing the concept of "management by objectives" [Trosa, 2002] within the water sector in an operational manner. This approach insists on management functional capacity rather than prescription of normative solutions for particular structural management elements.

2.1. Water sector and performance

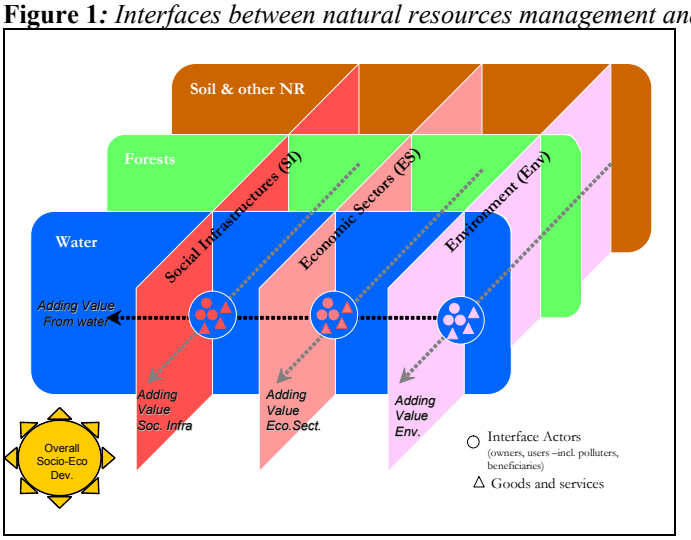
The choice of a managerial approach leads to a rather "inclusive" definition of the water sector, considered as an open production system, adding value from the mobilization and use of water as a particular natural resource:

The "water sector" consists in all means and activities devoted to creating added value from the water resources on a given territory.

This "value chain" comprises two segments (i) «**resources**» activities influencing the spatio-temporal distribution and/or the quality of the water resources with a view to manage these resources as an asset (ii) «**uses**» activities using water in transformation processes with a view to create socio-economic or environmental value (e.g. water supply, agriculture, industries)

This definition is meant to capture the operational "foot print" of water resources on the socio-economic and environmental development system of a given territory.

Figure 1*: Interfaces between natural resources management and "uses sectors"*



The simple reference to value creation implies an explicit reference to particular objectives. Defining or assessing the socio-economic or environmental value created from water resources implies clarifying the framework of objectives assigned to the use of these water resources. At this stage, it is important to note that the most commonly accepted definition of IWRM is in fact providing such a framework for the water sector:

> IWRM is a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems *(Global Water Partnership, 2000)* [GWP, 2000].

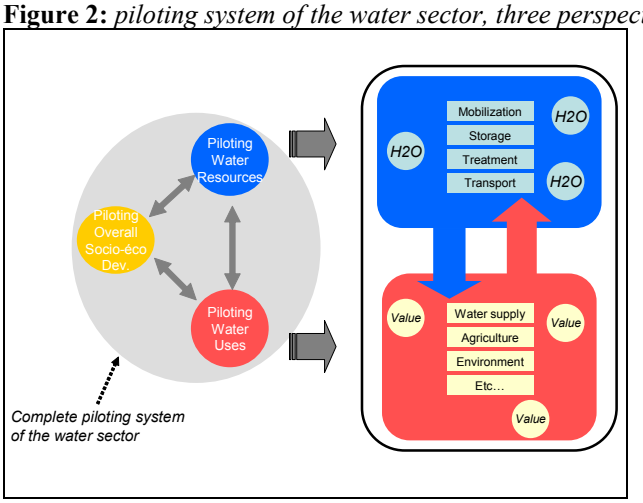
This definition refers to "coordinated" management but falls short of providing operational indications as to how coordination or integration is to happen. Its main purpose lies in fact in assigning sustainable development objectives to the water sector in the form of a socio, economic and environmental compromise (often refers to as "3E" for social Equity, Economic efficiency and Environmental sustainability [Barraqué, 1995][1]). It is important to note upfront that the "3E" objectives are complex. Setting 3E objectives implies revealing the socio-economic and environmental preferences of a population endowed with water resources on a given territory and calls therefore for objectives setting and management processes involving closely this population.

2.2. Water sector management and IWRM characteristics

The definition adopted for the water sector led to the distinction of 2 segments in the production system aiming at creating value from the water resources. These 2 segments have piloting systems following 2 distinct rationales: **(i)** overall resource valorization, as an asset (rationale embedded e.g. in water resources administrations, central or decentralized), **(ii)** environmental and sectoral valorization through uses of the water resources (rationale embedded in uses sectors e.g. water supply, agriculture, industry). In addition, these 2 segments are dependant of **(iii)** the overall political system on the considered territory, in charge of providing the main orientations for socio-economic development (rationale embedded e.g. in States, decentralized collectivities such as communes, regions etc)

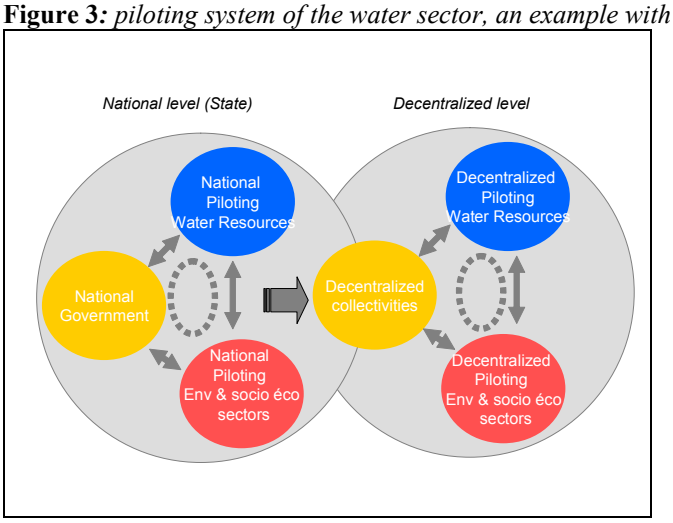
[1] The 3E acronym will be used thereafter in the article

Figure 2: *piloting system of the water sector, three perspectives.*



This structure of the water sector piloting system based on three perspectives needs to be completed by taking into account the territorial dimension. For a given territory many piloting levels may need to be considered relating to (i) administrative boundaries and (ii) hydrological boundaries defining basins or aquifers [Ghiotti, 2006].

Figure 3*: piloting system of the water sector, an example with 2 levels.*



The joint consideration of perspectives and territorial dimensions defines the basic architecture of the piloting system and leads to considering many decision making levels.

In order to ensure that the water sector can indeed be steered towards overall objectives, the piloting system available at each decision making level needs to fulfill three basic functions as a pre requisite: (i) **Dedication** through the definition of objectives**;** (ii) **Regulation** of functioning according to these objectives; (iii) **Coordination** at the interfaces according to these objectives.

These three functions are fulfilled through mobilizing management elements of various types (relating to policies, institutions or instruments) [GWP ToolBox, 2008] constituting the elementary bricks of the piloting system. In line with this approach, checking if a piloting system has "IWRM characteristics" can be translated as follows: checking if its constituting management elements have the potential to steer the water sector towards achieving a set of 3E objectives.

Table 1 : *management functions and IWRM characteristics*

Management functions	Key management domains	IWRM characteristics?	Underlying IWRM principles
Dedication through objectives	• Strategic frameworks • Participatory frameworks	Are means in place to ensure the **dedication** of water sector functioning to objectives taking into account the sustainable socio-economic valorization of water resources (objectives «**3E**»)? –> IN ORDER TO HAVE "IWRM *RELEVANCE*"	• Separation • Subsidiarity • Information • Participation
Regulation of functioning /objectives	• Planning, budgetary processes • Production management • Capacity management • Monitoring & evaluation	Are means in place to ensure the **regulation** of water sector functioning in order to achieve **3E** objectives? –> IN ORDER TO HAVE "IWRM *EFFICACY"*	• Basin management • Transparency and benchmarking for uses sectors
Coordination of interfaces /objectives	• Incentives schemes • Conventions • Regulatory framework	Are means in place to ensure the **coordination** at the interfaces with decision making levels following different perspectives («development», «resources» or «uses»), in order to create more **3E** value? –> IN ORDER TO HAVE "IWRM *CONVERGENCE"*	• Polluters pay • Users, beneficiary pay • Holistic view of resources

The above referential outlines an "IWRM audit" methodology applicable for auditing the piloting system of the water sector on a given territory. This methodology is based on the analysis of the constituting elements of the piloting system and the verification that these elements can ensure the steering of the water sector towards 3E objectives. A rather systematic inventory of management elements and related 3E criteria that should be verified can be undertaken in order to design an operational grid for analysis. For a given territory, a description of typical management elements constituting an "IWRM piloting system" for the water sector can thus be proposed, in the form of a check list organized around three viewpoints:

1. Types of elements used to construct the piloting system
2. Functions of the piloting system
3. Perspectives along which the system is piloted

Table 2: *a check-list of "management means" of:*

Three TYPES

P&L	Policies & legislation
Insti.	Institutions
Instr.	Instruments

=>For ensuring three FUNCTIONS

DEDI	Dedication of functioning through 3E objectives
REGU	Regulation of functioning / 3E objectives
COOR	Coordination of interfaces / 3E objectives

=>Along three PERSPECTIVES

D	Global socio-economic Development
R	Water Resources
U	Water Uses

2.3. Indicators for appraising the water sector

The IWRM audit approach suggested above leads to defining "**management indicators**" and a scoreboard on the piloting capacity of the water sector within a given set of overall objectives. These indicators can be derived from a survey of the existence of the "IWRM management means" referred to above as a three dimensional checklist. For a given piloting system, scores can be attributed reflecting the satisfactory existence of these management means. The indicators can then be obtained by adding up these scores along the different dimensions of the check list and converting the sums into percentage (actual/ total possible).

Indicators of "governability" are thus designed, indicating the capacity of the water sector to pilot itself towards achieving 3E objectives. This capacity is assessed by perspective, by piloting function, by type of management element or simply overall. Depending on the number of sectoral uses selected, the analysis leads to defining a dozen of indicators.

Table 3: *list of management indicators relating to the water sector*

Domains		***Indicators***
PERSPECTIVES	**O**	3^E Governability, overall
	D	3^E Governability / socio-eco development
	R	3^E Governability / water resources management
	Uws	3^E Governability / water supply
	Uenv	3^E Governability / environmental uses
	Uag	3^E Governability / agricultural uses
FUNCTIONS	**DEDI**	Capacity to dedicate functioning to 3E objectives
	REGU	Capacity to regulate functioning / 3E objectives
	COOR	Capacity to coordinate interfaces / 3E objectives
TYPES	**P&L**	Level in terms of 3E policies & legislation
	Insti	Level in terms of 3E institutions
	Instr	Level in terms of 3E management instruments

In line with the introductory statements on the necessity to explore linkages between management and performance in a given context, two complementary sets of indicators are required in order to investigate the question of the water sector performance on a given territory:

(i) The potential of the territory needs to be qualified through **«context indicators»**. These indicators provide a scoreboard on the natural, human and economic capital (including the stock of hydraulic infrastructures) of this territory. The selection of indicators results of choices made among the possible naturalist description of a territory (e.g. climate, hydrology, demography, macro-economic environment). Only territories with relatively similar contexts can be compared.

(ii) Finally, the results obtained by the water sector on this territory can be captured by **«performance indicators»**. These indicators provide a scoreboard on the productivity, efficacy and impact of the water sector on this territory in relation to given objectives. Within the framework of 3E objectives the selection of indicators is based on a "typical" understanding of the creation of sustainable socio-economic value from water resources (e.g. water quality, equipment use efficiency, access to potable water and sanitation, agricultural water productivity).

3. Illustration: the case of Burkina Faso

The methodology is being tested in the context of the West African water resources observatory. Preliminary work has been undertaken in Burkina Faso, in order to test the feasibility of the three sets of indicators mentioned above.

3.1. Data collected

Management

A questionnaire has been designed in order to document the existence, quality and operationality of about 130 "IWRM means". The questionnaire was filled by a national expert (2 days work) for the case of Burkina Faso. An extract of the filled questionnaire is provided below. The table comprises a code and descriptive statement for each of the IWRM means selected in the check list. All IWRM means are assessed from three points of view (existence, quality, operationality) leading to a global score varying from 0 to 3.

Table 4: *extract of governability questionnaire for Burkina Faso- scores*

Code IWRM means				Descriptive statement IWRM means		Scores			
Ind.	*Persp.*	*Fct.*	*Type*	*Element*	*Criteria*	*A1*	*A2*	*A3*	*Total*
1	D	DEDI	P&L	Decentralization policies	*Institutionalize the principle of territorial subsidiarity*	1	0	1	2
42	R	DEDI	Insti	Stakeholders participation organs	*Are based, at all governance level, on a robust inventory of actors and the subsidiarity principle (national organ, basin comities, local comities)*	1	1	0	2
64	R	COOR	Instr	Environmental allocation system	*Defines environmental discharges for surface flows and standards for water tables dynamics*	1	0	0	1
72	Uws	DEDI	Instr	Potable water observatory	*Includes performance indicators (e.g. coverage, price, quality)*	1	1	1	3

Table 5: *extract of governability questionnaire for Burkina Faso -appreciations*

	Appreciation of IWRM means		
Ind.	*A1: justify "presence/absence"*	*A2: justify "satisfactory quality /unsatisfactory"*	*A3: justify "operational/non operational"*
1	Institutionalized through law n°055-2004/AN on territorial collectivities in Burkina Faso and related decrees	Clear lack of human resources and financial means in the rural communes	Partially operational, mainly in urban communes
42	Elements provided under domain no 7 of the PAGIRE (institutional framework) and related decrees from the water law.	The participation framework is legally established and functions at the national level. The stakeholder representation is adequate but discrepancies regarding capacities of different actors may hinder the negotiation power of certain stakeholder groups	The participation framework is only operational at the national level. Work in progress at regional and local level (basin comities and CLE).
64	Institutionalized in the environment code ad the water law.	Unsatisfactory due to the difficulty in defining environmental flows suitable for the national context.	Non operational
72	The framework of PN-AEPA which includes donors constitutes an observatory of the water supply sub sector.	Satisfactory	Operational

Context and performance

Context and performance indicators were selected within the broad categories suggested above. Public databases available on the web constitute an important source of national level data [FAO, 2006].

Table 6*: Selection of context indicators and data sources*

	Indicator	***Source***
Hydrology	Total renewable water resources / year	Pacific institute
Hydrology	Total hydroelectric capacity (technically exploitable)	World Energy Council
Demography	Total population	UN
Demography	Urban population / total pop	UN
Adaptability	Human development index	UN
Macro-economic env.	GDP/cap (PPP)	UN
Macro-economic env.	% GDP from agricultural sector	CIA
Macro-economic env.	Investment climate index	Heritage Foundation
Macro-economic env.	ODA flows to water sector	Pacific institute
Stock of infrastructures	Water surface storage	FAO-aquastat
Stock of infrastructures	Areas equipped for irrigation / potential	FAO-aquastat

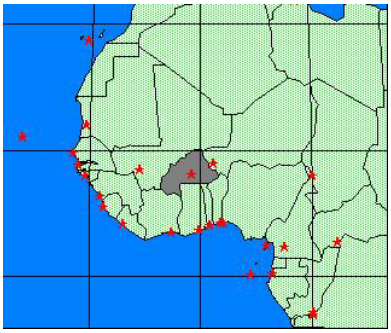
Table 7*: Selection of performance indicators and data sources*

	Indicator	***Source***
Efficiency equipments	Areas irrigated / equipped	FAO-aquastat
Running costs	Non revenue water	IB-NET
Sustainability	Water stress index	Pacific institute
Sanitation	Access to sanitation	JMP
Water supply	Access to potable water	JMP
Agriculture	Value agricultural production / water used in agriculture (/PPP)	CIA/Pacific
Impact Social	Water related diseases (Proxy)	UN
Impact Social	Cost of potable water for low income households	IB-NET
Impact Env.	Water footprint	IHE
Impact Env.	Biodiversity index	Yale

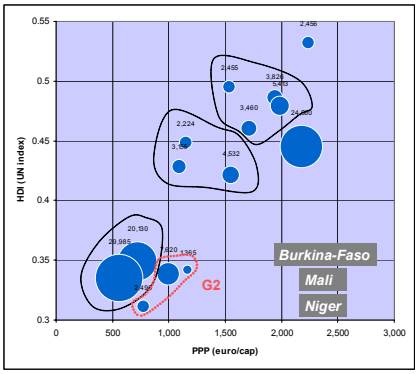
Two larger sets of indicators (30 indicators incl. the selections above) were tested in Burkina Faso. Data relating to context and performance indicators were collected by approaching the relevant administrations (DGRE, INSD, SONABEL, Economy and Finance Department). Most of the context indicators (70%) were obtained after 2 days. Only 40% of the performance indicators were obtained within the same timeframe. The main difficulty encountered concerned the availability of economic data relating to the water sector. Nevertheless, the short list of 10 indicators selected above proved to be available at national level (via proxy in some instances).

3.2. Water sector appraisal

For the sake of illustration, the format synthesizing the results obtained for context, management and performance indicators in the case of Burkina Faso is presented hereafter. The main contribution of the methodology highlighted in this article relates to the management indicators. However, the analysis of these management indicators becomes more meaningful while considering in parallel context and performance indicators. The experimental nature of the work and the necessity to further develop the methodology to increase its robustness has of course to be emphasized again at this point.



BURKINA FASO



Typology country :

- Context : G2
- Governability : **0.70**
- Performance : (-)

Context indicators

Indicator	Unit	
Total renewable water	*km3/y*	17.5
Total hydroelectric capacity	*TWh/y*	1
Total population	*'000*	12,822
Urban population/ total	*%*	18%
Human dev. index	*(0,1)*	0.342
GDP / cap (PPP)	*$/cap*	1,169
Contribution agric. to GDP	*%*	33%
Investments climate index	*%*	55%
ODA to water sector	*$/cap/y*	3.42
Surface storage capacity	*km3*	5.1
Irrigated areas/ potential	*km3*	15%

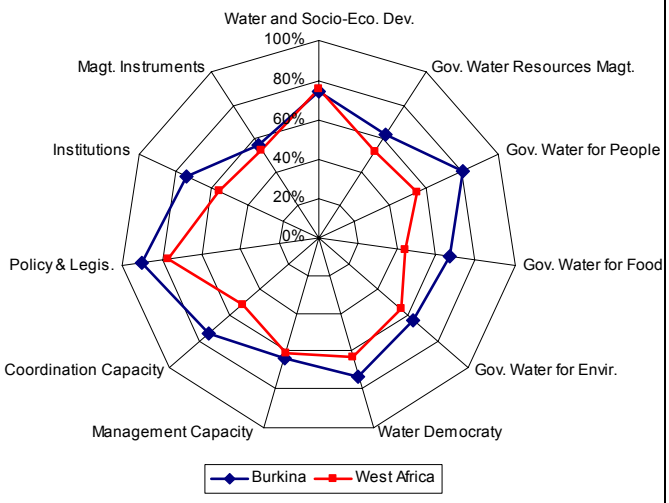
Context, management, performance of the water sector

The context indicators provide a general profile of the country potential. Burkina Faso is characterized by low renewable water availability and a low human development index.

The management indicators provide a general assessment of the capacity of the water sector to be steered towards 3E objectives. Indicators in Burkina Faso show a good level of development of policy and institutional elements. The coordination capacity between resources and uses management as well as the governance of the water supply sub-sector appear relatively robust.

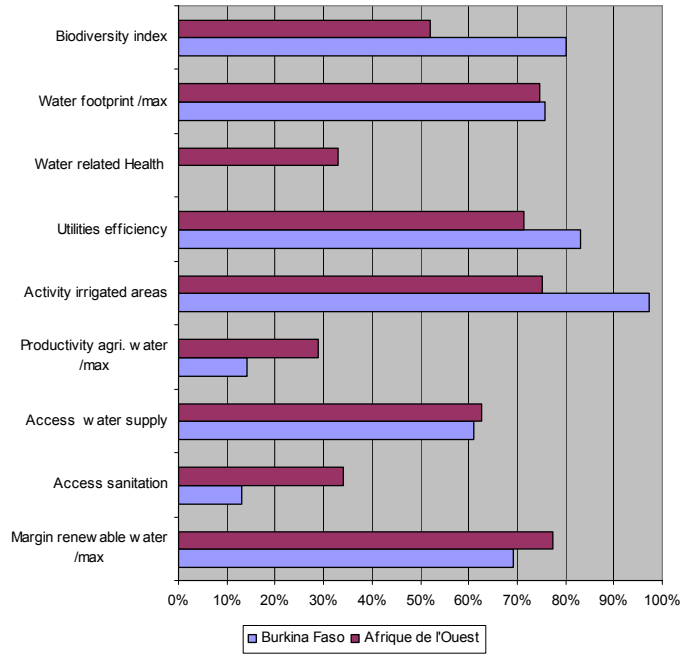
The performance indicators provide a general outlook on the results obtained by the water sector in terms of achieving 3E objectives (efficiency, efficacy, impact). The performance of the water sector in Burkina Faso is close to the average level observed in the West African region. Access to sanitation is low. The economic productivity of agricultural water is relatively low.

Management indicators



Data obtained through experimental work (questionnaire 2007 consultant for Burkina; IWRM course for region)

Performance indicators



Performance data obtained from web sources

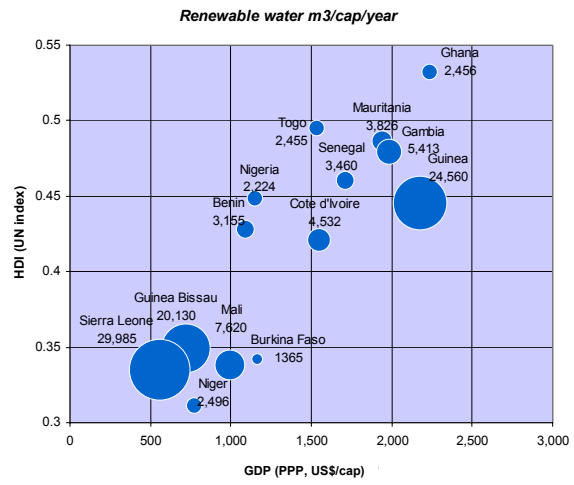
4. Perspectives

The approach described in this article is under development. Debates have been entertained in the context of IWRM courses targeting West African water professionals organized in 2006 and 2007 [ASDI, 2008] and further thinking is occurring within the program implemented by WRCU for setting up a regional water observatory. The IWRM courses have provided the opportunity to test and fill the questionnaire on governability for 6 West African countries (Benin, Burkina, Côte d'Ivoire, Guinea, Mali, Togo); the resulting data set has been used as a «proxy» for computing regional averages for the indicators, presented in the spider diagram above.

The efforts currently underway consist essentially in validating the set of indicators, collecting additional data and organizing debates around the results, possibly leading to analysis of correlations between the characteristics of management systems and level of performance obtained. Perspectives of further uses of the methodology appear interesting and a few remarks relating to two main areas of application are provided below.

4.1. Regional benchmarking

The analysis of context indicators for West Africa provides general country profiles. For illustration purposes, three context indicators (x: HDI; y: GDP-PPP; bubble size: renewable water/cap/year) have been plotted on the graph below.



Group 1: Guinea Bissau, Liberia, Sierra Leone. (Important renewable water resources and low human development index).
Group 2: Burkina, Mali, Niger (Low renewable water resources and low human development index).
Group 3: Côte d'Ivoire, Benin, Nigeria (Low renewable water resources and average level human development index / region).
Group 4: Gambia, Mauritania, Senegal, Togo (Low renewable water resources and above average level human development index / region).
Group 5: Capo Verde, Ghana, Guinea (outliers: Capo Verde and Ghana are more developed compared to the regional average; Guinea has important natural resources, notably water resources).

The performance level of the water sector varies within each of these groups and it is relevant to question the role of different management choices in explaining these variations of performance. Through initiating and entertaining such debates and comparative analysis at country level, WRCU can play a very useful role as catalyst and support of national water sector improvement processes.

4.2. IWRM managerial audit

The concept of "referential" introduced above and commonly used in relation to certification processes refers mainly to the use of a technical framework for analysis, defining the characteristics expected to be found while scrutinizing a particular product or service and the ways and means to control the conformity of the product or service to these characteristics [Jounot, 2004]. It is not unreasonable to expect that the approach presented above could lead to elaborating an "IWRM referential" providing the foundation for auditing the piloting systems of the water sectors on various territories (State, region, basin) with a view to granting functional quality certification. The aim should not be to define a norm but to elaborate a grid for analyzing piloting systems and check if they are equipped to steer the water sector towards sustainable socio-economic development objectives. As stressed earlier, the approach is centered on quality management, not structural specifications.

It is important to pursue efforts towards IWRM for securing investments, particularly in a context of increased interest of the donors and governments towards the water sector. Through relatively quick auditing processes, a managerial approach can highlight the areas where intervention might be required in order to increase the capacity of the water sector to steer itself towards achieving 3E objectives. The use of a widely recognized IWRM referential could play in fact a positive indirect role in lowering the perception of water sector engagement risks by the investors.

Designing meaningful interventions addressing the "problem areas" identified by the auditing process requires careful diagnoses. The issues pertaining to these diagnoses have not been treated in this article. The domain of "IWRM intervention" implies investigating the determinants leading to the existence of management means which can be assessed as "dysfunctional" with regard to 3E objectives. While acknowledging the extreme diversity encountered in the different corners of the world, it is probably reasonable to believe that most of the profound determinants originate within value systems (political, cultural) which, at some level, enter in contradiction with the 3E compromise. Understanding fully these determinants is of course a pre requisite, before undertaking any intervention aiming at altering the management elements in areas detected by the audit as "having low 3E piloting capacity".

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