Integrated water resources management performance analysis: results of a pilot study in West Africa

J. Rey, A. Tengnäs, H. Lévite and I. Ouédraogo

ABSTRACT

This paper describes a pilot study that aimed at testing a set of indicators for the evaluation of the national water sector in West African countries. The set of indicators is based on a representation of the water sector as a production system embedding a value chain. The information relating to the production system is structured in three blocks: the context, the functioning (inputs and outputs) and the governance. The pilot study covered five countries and the results were debated in two regional workshops, led by the Water Resources Coordination Center of the Economic Community of West African States. The results show that the method gives an in-depth analysis of the water sector, in particular of water governance. The governance indicators can be used for periodical integrated water resources management (IWRM) audits but the complexity requires significant efforts in order to collect reliable data, in particular in West Africa where information tends to be fragmented.

Key words | benchmarking, IWRM assessment, water governance, West Africa

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INTRODUCTION

West Africa is, since 1998, committed to a regional process that aims to implement integrated water resources management (IWRM). A Permanent Framework for Coordination and Monitoring of IWRM in West Africa was set up (Economic Community of West African States (ECOWAS) 2007) with the ECOWAS Water Resources Coordination Center (WRCC), being its executive body (WRCC, ECOWAS 2013).

The WRCC monitors the evolutions of policy, institutions and legislation that are put in place at country level (Table 1; WRCC, ECOWAS 2013), using a roadmap approach (United Nations Environment Programme (UNEP) 2012). The African Ministers' Council on Water (AMCOW) has prepared similar indicators for the continent (AMCOW 2012). This traditional assessment method mostly evaluates the existence of IWRM policies, legislation and institutions and does not engage with practices (i.e. it does not provide information on the IWRM character of investments or management decisions being taken in the field).

In a context of new investments for infrastructure development (Brachet *et al.* 2013), a more in depth evaluation of the water sector is needed in order to appropriately assess and analyse the persisting water governance and management issues that are often identified as reasons for delays, increased costs and environmental and social impacts. The need to develop tools/framework that can allow assessment of the water sector is also highlighted in a number of academic articles and books on the status of water management in Africa (e.g. Julien 2013).

A key component of the WRCC programme attempts to address this need: the setup of a regional water observatory as a tool to facilitate the monitoring of the water sector at country and basin levels. An important aspect of the regional water observatory relates to the monitoring of IWRM implementation, with three main objectives:

- Perform comparative analysis on the implementation of IWRM principles.
- Feed a database on IWRM implementation practices at the regional level.
- Contribute to evaluating the IWRM processes and inform investment decisions.

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Table 1 | Status of IWRM implementation in West Africa in 2012 (WRCC, ECOWAS 2013)

Legend:
- ● Yes/exists
- o Partially existing
- ➔ Underway
- F Planned
- X No/does not exist
- * Specific case of Niger that is planning "water management units"
- **n.a.** = non applicable

			POLICY		LEGISLATION								INSTITUTION			
Country	**Roadmap**	**Action plan**	Existence of a national water policy	The policy is based on IWRM principles	Existence of water laws and regulations	Stakeholder participation in water management	Water management based on basins	Subsidiarity principle	User pays principle	Polluter pays principle	Particular role of women	Implication of the private sector	Existence of a cross-sector organ	Existence of a coordinating inter-ministerial organ	Existence of a consultative organ	Existence of bodies for river basin management
Benin	n.a.	Completed	2009	●	2010	●	●	●	➔	➔	➔	●	●	➔	●	o
Burkina Faso	n.a.	Completed	1998	●	2001	●	●	●	●	●	X	●	●	●	●	● 5
Cap Verde	n.a.	Completed	➔	●	1984	●	●	●	●	●	X	o	●	●	➔	X
Côte d'Ivoire	Completed	Completed	2013	●	1998	●	●	●	●	●	●	●	●	➔	➔	➔
The Gambia	Completed	Initiated	2007	●	1979	●	●	●	●	●	●	●	●	●	●	n.a.
Ghana	n.a.	Completed	2007	●	1996	●	X	X	●	o	X	X	●	F	●	● 5
Guinea	Completed	Initiated	➔	●	1994	●	●	➔	➔	➔	X	X	●	X	●	● 3
Guinea-Bissau	Completed	Initiated	1992	o	➔	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	X	●	●	➔
Liberia	Completed	Completed	2007	●	●	●	o	●	●	o	●	●	➔	●	➔	➔
Mali	n.a.	Completed	2006	●	2002	●	●	●	●	o	●	●	●	●	●	● 2
Niger	n.a.	Planned	2000	●	2010	●	●	●	●	●	●	●	●	●	●	7*
Nigeria	Completed	n.a.	2009	●	1993	o	●	o	o	o	X	●	X	X	●	●
Senegal	Completed	Completed	2005	o	1981	●	●	●	●	●	●	●	●	●	●	● 1
Sierra Leone	Completed	Initiated	2010	●	2004	●	o	X	X	X	o	X	●	●	➔	F
Togo	Completed	Completed	2010	●	2010	●	●	●	●	●	X	X	●	●	➔	➔

While developing the concept of the regional water observatory, a set of water sector indicators has been identified through an initial collaborative process (Rey *et al.* 2008). These indicators were tested in five countries in West Africa (Burkina Faso, Cape Verde, Ghana, Mali and Senegal) through a pilot study conducted between December 2011 and March 2012: 'West Africa Regional Water Observatory, Water Management Performance Analysis – a Pilot Study of 5 countries'. This paper refers to the design and findings of this study. The complete representation of the water sector used for defining the indicators is presented in some detail, followed by a few results and analyses. A closer attention is devoted to the subset of governance indicators leading to a discussion on IWRM audit.

METHOD

The WRCC aims at developing a comprehensive set of indicators that provides a snapshot of the water sector available at national level through cost effective surveys. This snapshot is meant to include governance indicators able to inform decision makers on the level of implementation of IWRM.

Representing the national water sector

A value chain

In this paper, the water sector is defined as: all people, means and activities directly or indirectly involved in creating net added value (e.g. food) from the water resources. The water sector can therefore be described as a production system. The value chain embedded in this production system comprises two main segments:

- A 'resources segment', with activities influencing the spatio-temporal distribution and/or the quality of the water resources as a whole.
- A 'uses segment', with activities using water in transformation processes creating value: 'social uses' (e.g. water supply), 'economic uses' (e.g. agricultural production),

'environmental uses' (e.g. functioning of ecosystems and cultural services).

Governing the value chain

Decisions made by the various actors having a stake in the value chain will have an impact on the overall value added from the resources. For the sake of simplicity, the actors are grouped according to three main perspectives:

(i) Overall socio-economic development (States and local governments, e.g. communes).
(ii) Water resources management (water resources administrations, river basin organizations, etc.).
(iii) Sectoral and environmental water uses (rationale embedded in uses sectors, e.g. water supply, agriculture, industry, energy, environment).

The resulting representation of the water sector is provided in Figure 1. It includes a relatively complex governance system with actors belonging to three main perspectives and intervening at different territorial scales (Table 2).

Information base

The representation of the water sector introduced above is underpinned by a set of information relating to (1) the context, (2) the dynamic functioning and (3) the governance (Rey & Vallée 2009). The context refers to the description of the existing resources within the system (such as water storage facilities, etc.), the functioning refers to the physical and economic flows occurring during a period of time within and across borders of the system (such as volume of water used

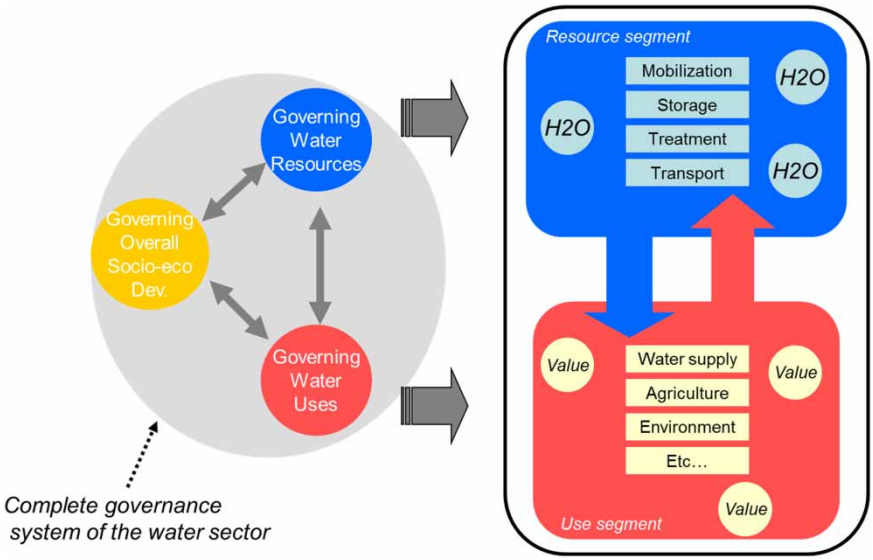

Figure 1 | Representation of the water sector, including three perspectives for its governance.

Table 2 | Examples of actors involved in the water sector at different scales within a territory

Perspectives	National level	Decentralized level-regions	Decentralized level-communes
Overall socio-economic development	Government, ministries of planning, finance	Regional councils, decentralized planning agencies	Municipal councils
Water resources	Ministry of water resources	Decentralized water administrations, basin agencies	Local basin committees
Water uses	Ministries of agriculture, industry, health, environment	Decentralized and deconcentrated sector administrations	Chambers of industries, unions, environmental associations

by different sectors), and the governance refers to the web of policies, institutional arrangement and management instruments that set the rules for how the system functions.

Information on context – assets and stocks of value accumulated

The stock of value accumulated at a given point in time refers to what is called above the 'context'. It comprises (i) human, economic and environmental capitals, (ii) infrastructure (production facilities) and (iii) natural resources (Table 3).

The different dimensions above are considered as stocks of value available for investment as inputs in the value chain. The description of the context refers largely to the general statistics collected in order to assess the level of development, the constraints and the potential of a selected territory.

Information on functioning – use of assets and flows of value created

The evolution with time of the stocks introduced in the description above is determined by multiple processes, which can be modelled with different levels of accuracy; this constitutes the functioning. At a conceptual level, the functioning of the water sector can be described by a set of value creation processes using water as an input and producing intermediate goods and services contributing to the accumulation of the human, economic and environmental capital (e.g. drinking water, agriculture, wetland services). The information base needed to describe the functioning of these value creation processes over a period of time includes a number of elements:

- Information on inputs (e.g. technologies of the value creation processes; water used: withdrawn, consumed or polluted).
- Information on outputs/outcomes (benefits gained from accessing and using water).

The information should be obtained in terms of physical and economic data. The dynamic dimension of the data collected should also be considered:

- Primary data (e.g. water used at a given time).
- Trends (e.g. pattern of water used over a year).
- Cumulative data during a period (e.g. total water used per year).
- Trends of cumulative data over a number of periods (e.g. pattern of total water used over several years).

Table 3 | Describing context

	(i) Capital
Human	Accumulated goods and services provided through social infrastructures and related outcomes (e.g. skills, knowledge, health)
Economic	Accumulated goods and services produced through economic infrastructures and related outcomes (e.g. mobility, connectivity, purchasing power)
Environmental	Accumulated goods and services produced through environmental infrastructures and related outcomes (e.g. biodiversity, air quality, landscape)
	(ii) Infrastructure
	Social (e.g. schools, hospitals); economic (production facilities); environmental (ecosystems); resources management (e.g. dams, storages)
	(iii) Natural resources
	The resource itself, available for uses processes, directly or through natural resources management infrastructure

Information on governance – managing assets and steering value creation

The combination of the three perspectives and different territorial scales (e.g. national, regional, and local) presented above leads to a mapping of actors involved in the water sector and of the corresponding decision-making levels. In order to be functional, the governance system available at each of these decision-making levels needs to embed 'three basic functions':

(i) Objectives setting at the given level.
(ii) Regulation of functioning at the given level according to these objectives.
(iii) Coordination at the interfaces with other levels according to these objectives.

For ensuring the overall governability of the water sector (the fact that it can be steered towards overall objectives

through the decisions of multiple actors), the functional characteristics of the governance system at all levels have to be described against their capacity to foster the pursuit of these overall objectives. Within a sustainable development framework, the overall objectives call for the creation of socio-economic and environmental value (referred to as '3E' for: economic Efficiency, social Equity and Environmental sustainability) with the water resources available in the territory. The corresponding '3E' governance, fostering the achievement of '3E' objectives, is translated as IWRM for the water sector (Table 4).

Ultimately, the key governance domains are addressed, at each decision making level, through mobilizing 'governance elements of three basic types': (i) policies and legislation, (ii) institutions and (iii) management instruments (Global Water Partnership IWRM ToolBox). The whole set of governance elements constitute the governance system. Each of them can be associated simultaneously to one of the three types, one of the three functions and one of the three perspectives (Table 5).

The study worked with a comprehensive set of about 150 governance elements for the national water sector and defined a desirable IWRM functional characteristic for each of them. The combination of a particular governance element and its IWRM functional characteristic is called an IWRM mean. The information on governance is obtained through investigating all defined IWRM means.

Table 4 | Functions, key governance domains and link to IWRM principles

Governance functions	Examples of key governance domains	Underlying IWRM principles
Objective setting	• Strategic frameworks • Consultative frameworks	• Separation • Subsidiarity • Information • Participation • Gender
Regulation of functioning/ objectives	• Planning, budgetary processes • Production management • Capacity management • Monitoring and evaluation	• Basin management • Transparency and benchmarking for uses sectors
Coordination of interfaces/ objectives	• Incentives schemes • Conventions • Regulatory framework	• Polluters pay • Users, beneficiary pay • Holistic view of resources

Table 5 | Summary of the governance system description – a three dimensional checklist of governance elements

Three types of governance elements			
P&L	Policies and legislation		
Insti	Institutional arrangements		
Instr	Management instruments		
Addressing 3 Functions			
OBJ	To set 3E objectives		
REGU	To regulate the functioning/3E objectives		
COOR	To coordinate at the interfaces/3E objectives		
From 3 Perspectives			
D	Socio-economic development	Uws	Utilization water supply
R	Water resources	Utr	Utilization transport
U	Water utilization	Uag	Utilization agriculture
Remark: Water utilization (U) may be split into various uses (Uws, etc.)		Uin	Utilization industry
		Uto	Utilization tourism
		Uenv	Utilization environment

Indicators

Indicators of context

Context indicators can be directly built from the information base, in terms of stocks of capitals and appreciation or depreciation of these capitals (not detailed in this paper).

Indicators of functioning

Functioning indicators can be directly built from the information base, in terms of flows of capitals, costs and value added (not detailed in this paper).

Indicators of governance

The building of governance indicators requires specific work, depending on the purpose. At the system level, the approach suggested above leads to defining a scoreboard on the governance capacity of the water sector within a given set of overall IWRM objectives. These indicators can be derived from a survey of the IWRM means introduced above.

For a given governance system, scores can be attributed to each IWRM mean by assessing its satisfactory existence, quality and sustainability. 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), with the option of weighting. For example, adding up the scores of all IWRM means belonging to the water resources management perspective and dividing this sum by the maximum possible score gives an indicator of 3E governability for water resources management.

Indicators of 'governability' are thus designed, indicating the capacity of the governance system to steer a given territory on a sustainable development path, from a water perspective (towards achieving 3E objectives – social, economic, environmental). This capacity is assessed by perspective, by governance function, by type of governance element or simply overall. Depending on the number of sectoral uses selected, the analysis leads to defining a dozen indicators (Table 6).

Table 6 | List of governance indicators relating to the water sector

Domains		Indicators
Perspectives	Overall	3^E Governability, overall
	D	3^E Governability/socio-eco development
	R	3^E Governability/water resources management
	Uws	3^E Governability/water for people
	Uenv	3^E Governability/water for environment
	Uag	3^E Governability/water for food
Functions	OBJ	Capacity to set 3E objectives (water democracy)
	REGU	Capacity to manage functioning/3E objectives
	COOR	Capacity to coordinate interfaces/3E objectives
Types	P&L	Level in terms of 3E policies and legislation
	Insti	Level in terms of 3E institutions
	Instr	Level in terms of 3E management instruments

RESULTS

Data collection

Availability of data

The consultants recruited for the study were experienced professionals of the five countries. They carried out the work during 2 weeks, spread over a period of two months. As stated in the methodology, the governance component of the survey relies heavily on expert judgment. Information on the 'context' proved accessible and of satisfactory quality (caveat: the need to clearly define and harmonize hydrological indicators was identified). Information on 'functioning' is more fragmented. Generally, the following challenges were encountered:

- There is little information available on wastewater treatment.
- Environmental degradation is not sufficiently monitored.
- Concepts, such as water withdrawn/demand and budget/costs, need to be clearly defined and harmonized across countries.
- Economic data are not easily accessible.
- The value of ecological services is a concept yet to be developed.

Harmonization of data

The WRCC made sure that the data collected could also be used (a subset) for other monitoring processes such as the AMCOW framework for monitoring the implementation of the Sharm el Sheikh agreement (AMCOW 2008) or the African Network for Basin Organizations framework for monitoring river basin organizations.

Overall data analysis

Towards snapshots of the water sector

The method allows for identification of potential weaknesses within countries. Conclusions can be drawn from the data and indicators on context, functioning and governance that give an overall performance analysis of the water

sector in the five pilot countries. To mention a limited sample of conclusions, the surveys showed that (i) the water sector in Cape Verde is not yet equipped for implementing IWRM and (ii) Burkina Faso has an enabling environment that should be conducive to good performance but lacks operational management frameworks (see below for more detail). Information can be drawn from looking at specific indicators, showing for example that (i) Mali's water sector is not generating enough financial resources for its operations and (ii) Ghana is increasing its efforts to reach down to local levels in order to slow down environmental degradation. The views from experts and the discussions that unfolded during two expert meetings indicated that IWRM implementation in Senegal, while effective, may be slowing down.

Example of Burkina Faso

For the case of Burkina Faso, the method allowed for a very good data collection rate, except for some economic data. The data on context highlight the limitations of Burkina Faso's natural resources endowment. Due to evaporation, only half of the renewable water can be used; hydropower potential is low and rivers are not navigable. There is a general degradation of natural resources, notably the soils in the northern part of the country and in the irrigated areas with partial water control. The phenomenon of degradation of the banks of the water bodies is increasing due to the strong pressure on the resource.

As shown by the data on functioning, the annual budget allocated for the construction or rehabilitation of water-related facilities is significant and increasing every year. The country has a large stock of water resource infrastructures (small dams and boreholes). However, these investments are still inadequate compared to the needs and the rate prescribed in investment plans to achieve the objectives set by the government. The annual operating budget of the water sector is very low compared to the effort required to manage the resource. Water volumes managed annually are negligible compared to the renewable resources that could potentially be mobilized. Local competition for the resources is sometimes exacerbated by the demand of new users such as the growing gold mining sector (Ribier-Tournaire 2012).

The value of goods and services produced by the water sector is estimated as very low. For instance, irrigation is underdeveloped although agriculture (largely rainfed) represents more than 40% of gross domestic product. Overall, there is a lack of economic data to assess the net value added by the water sector. The following are examples of unavailable data: economic value lost due to droughts and floods; value of ecosystem services and amount of water needed to sustain these services; revenue generated from different water user fees. Only some institutions are doing pioneering work in these areas, such as the International Union for Conservation of Nature for water ecosystems valuation (UICN 2010).

Regarding governance data, the Government has made efforts towards integrated management of natural resources by creating an enabling legal environment and through the establishment of national (SNAT) and regional (TARS) master development plans. Since 1998, the Government has adopted the IWRM approach as a method for managing water resources (a framework law was adopted in February 2001). A financial contribution from the water uses was set in 2010 to fund water agencies responsible for resource management in the basins. The water agencies and other mechanisms on the ground are being gradually operationalized. Overall, the enabling conditions for a good water sector performance have been set but the operational management frameworks are not yet in place, which in turn leads to a lack of capacity to manage and protect the resources. The incentive for trans-boundary cooperation in Burkina Faso is high. Information on governance indicates that Burkina Faso has made significant effort to establish appropriate policies and legislation. Several international conventions that related to water are signed and commitments to main river basin organizations have been made.

Specific analysis of the governance indicators in terms of IWRM audit

IWRM governance audit in the five pilot countries

Graphs are presented below (Figure 2) as simple illustration of the work undertaken on governance indicators in the five

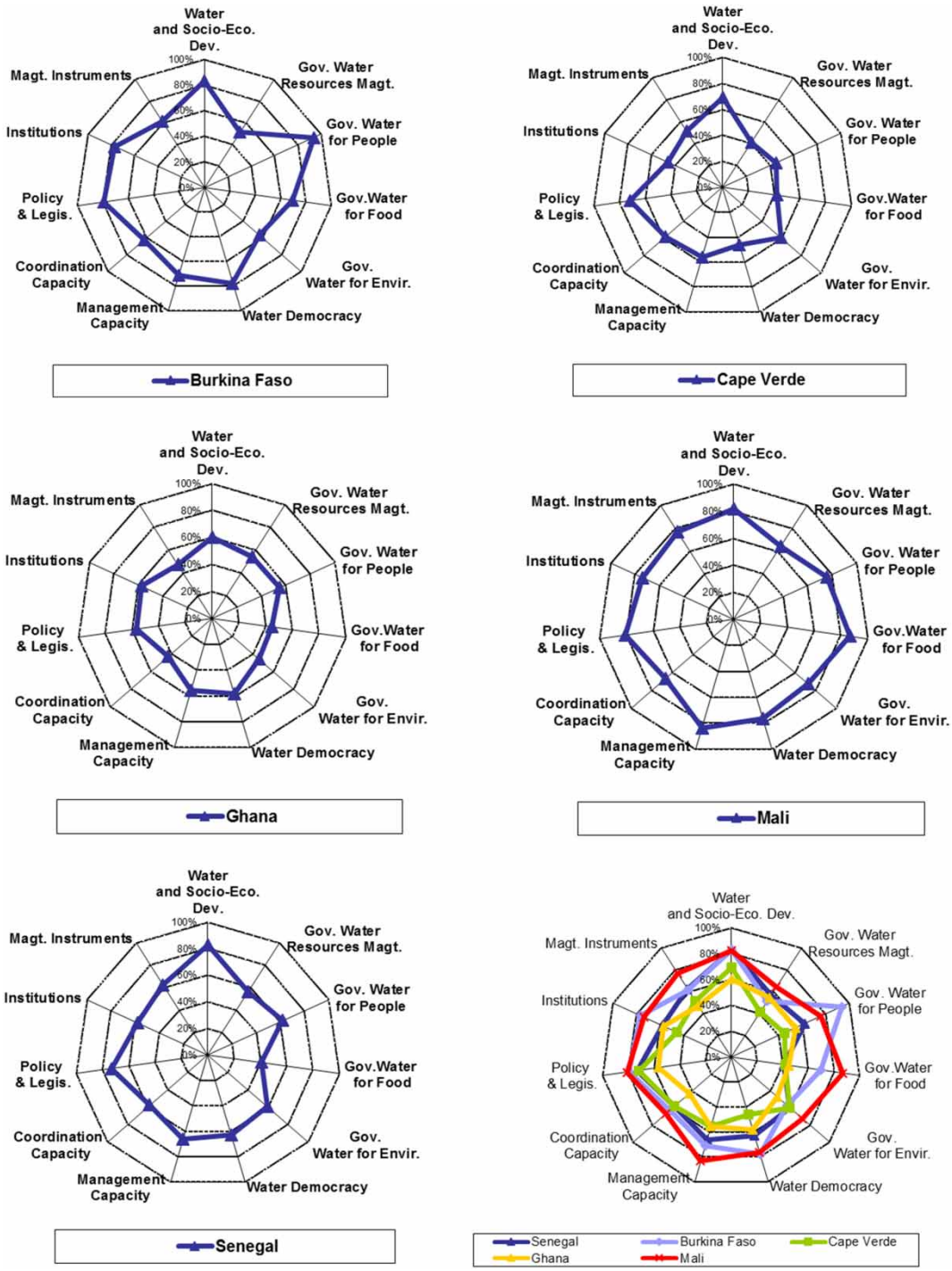

Figure 2 | Example of a possible analysis that can be produced from the information gathered by using the method that is presented.

pilot countries. They should be considered as entry points for discussing the many facets of water governance at national level, not as objective assessments of the water sectors in the five countries. The information required to inform the indicators is often of qualitative nature and relies to some extent on expert judgments.

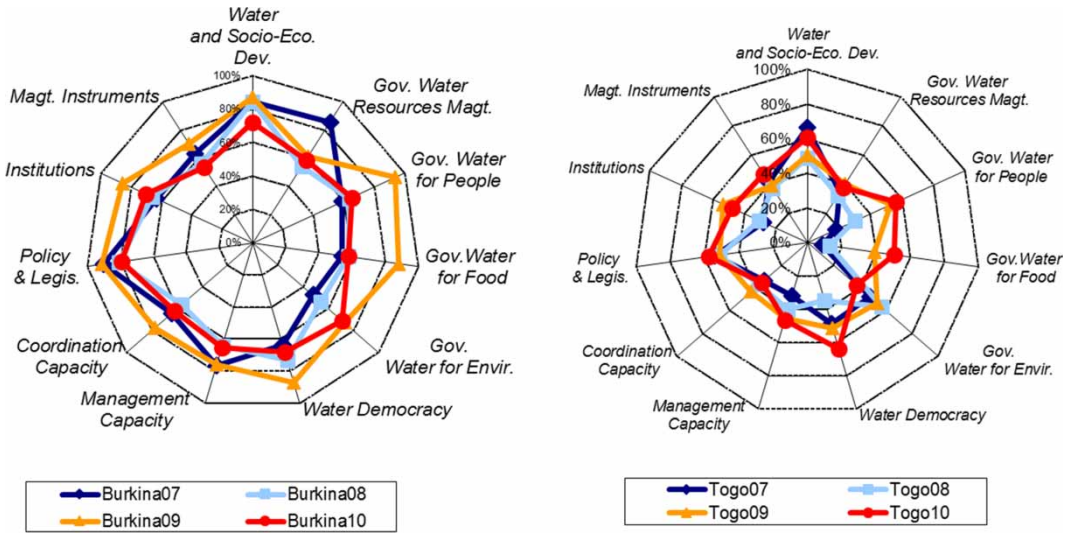

Figure 3 | Analysis of Burkina Faso and Togo from 2007 to 2010.

IWRM governance audit used for training purpose

With support by Sida, a consortium comprising Global Water Partnership/West Africa, Ramböll and Stockholm International Water Institute designed and implemented a West Africa IWRM course, attended by 162 mid-career professionals (ECOWAS 2013). The method described in this paper was used for four consecutive years in small country groups with interesting similarities in the judgment of their respective national water sectors (Figure 3).

The participants had a large diversity of background and professional activity (administrations, non-governmental organizations (NGOs), academic institutions, media, etc.). The use of the framework naturally led to discussions around the status of water governance in the respective countries of the participants. No individual in the groups would have been able to cover the whole range of issues in the checklist leading to indicators but the complementarities of backgrounds allowed the emergence of a collective representation of the water governance system which proved enriching.

CONCLUSION

The underlying framework leading to the definition of indicators is important for structuring the interpretation of the data collected. The conceptual framework chosen in this study provides a fairly comprehensive picture of the water sector allowing a discussion of the role of water within the socio-economic system. The framework remains flexible and allows the inclusion of additional perspectives (e.g. adding indicators for additional water uses).

The availability of data is still a key challenge because of the dispersion of the information, the reluctance of certain actors such as ministries of finance to share data, and the lack of harmonization. The added value of collecting information needs, of course, to be clearly proved to countries. ECOWAS attempts to address this issue on a regional level through the on-going creation of a regional observatory.

The study shows that it is useful to look at the water sector from a value chain perspective. The possible analyses create a comprehensive representation of the sector and thereby allow important actors and the corresponding decision-making levels to be identified. In addition, the value chain approach is important because it connects governance to concrete results. This is needed in order to make the case for water governance staying high on the agenda. However, more work is needed to ensure the political acceptance of 'IWRM audits'.

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