

## Evaluation of the implementation of IWRM in the lower Oueme valley, south Benin

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### Abstract

The objective of this study is to assess the level of application of integrated water resources management (IWRM) in the lower Oueme valley. In order to achieve this, interviews with the actors' families allowed, on the basis of the survey on indicator 6.5.1 of the Sustainable Development Goals, to represent the degree of implementation of IWRM in the lower Oueme valley using a United Nations (UN) form. The results of this analysis reveal a low level of IWRM implementation with a score of 31 on a scale of 0–100. The weaknesses identified are mainly related to the lack of funding (score of 20/100) to cover all aspects of the development and management of water resources. Inadequate instruments or tools (score of 25/100) to enable decision-makers and users to make rational and informed decisions between different options and action measures, the unfavourable environment (score of 35/100) and finally weak institutional efficiency (score of 45/100), intersectoral coordination, and the involvement of various other stakeholders, are all evils that undermine the efficient management of water resources in the lower valley of Oueme.

**Key words:** application level, IWRM, low, lower Oueme valley

### Highlights

- A percentage of the degree of implementation of IWRM in the study sector (31%).
- Comparison between the national value given by UN Dataportail and the study area.
- The percentage of implementation of each IWRM aspect individually.
- The views of each stakeholder on specific aspects of IWRM implementation, especially on the subject of figures.
- To make the link between the intervention of the various institutions.

### INTRODUCTION

Natural resources, especially water, are not inexhaustible and are as vulnerable as human beings. They therefore require rational and concerted management that respects the environment. Access to drinking water for the greatest number of people, securing this resource, which is often over-exploited and poorly managed, and pollution problems due to urbanisation, are all major challenges for global governance.

In Benin, the country has a water resource potential of 13.106 billion m<sup>3</sup>/year on average for surface water and 1.870 billion m<sup>3</sup>/year on average for groundwater recharge (DH 2000). However, these water resources

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are increasingly exposed to the combined effects of demographic pressure, pollution due to human activities (Odoulami 2009) as well as climate variability, which are leading to a reduction in the quantity of water available per inhabitant (BEPP 2012). In order to deal effectively with this situation, Benin has adopted integrated water resources management (IWRM) since 1998. Indeed, the country adopted Law No. 2010-44 of 24 November 2010 on water management in line with the guiding principles of the approach. In the same vein, a National Action Plan for Integrated Water Resources Management (PANGIRE) has been drawn up and is currently in its second phase, 2016–2020 (General Direction for Water 2011). All this is under the guiding thread of a National Water Policy document that guides Benin's vision for the development and management of water resources. However, the implementation of this management at the national level and, in particular, in the Oueme basin is rapidly facing certain obstacles. Several authors have worked on water resources in the basin, but this is the first time that a study makes a quantitative assessment of the implementation of IWRM with a participatory approach in the lower Oueme valley.

## METHODS

After a brief presentation of the study environment, the approach adopted focused on data collection and analysis.

### Presentation of the study environment

A summary presentation of the study area shows that the lower Oueme valley, the Porto-Novo lagoon and lake Nokoué together form a vast wetland, the largest in Benin, with 91,600 hectares. It is protected by the Ramsar Convention (Ramsar Sites Information Service 2019, <https://rsis.ramsar.org/fr/ris/1018>). Officially the Convention on Wetlands of International Importance especially as Waterfowl Habitat, also commonly known as the Convention on Wetlands, it is an international treaty adopted on February 2, 1971 for the conservation and sustainable use of wetlands, which aims to stop their degradation or disappearance, today and tomorrow, by recognising their ecological functions as well as their economic, cultural, scientific and recreational value.

The climate is sub-equatorial with four unevenly distributed seasons, two rainy and two dry, alternating between dry seasons (November to March and mid-July to mid-September) and rainy seasons (April to mid-July and mid-September to October). The hydrological regime of the Oueme is characterised by a minimum flow in March and a maximum flow during the high water period in September, but the low water period extends from January to May inclusive (Cocker *et al.* 2019). The flood arrives in June and the flow increases until September and remains close to the maximum during the month of October (Moniod 1973). Before flowing into the Porto-Novo lagoon, the Oueme river creates a real inland delta with a vast flood plain. The area of this interior delta constitutes the lower valley of the Oueme. The present study is limited to five communes of this valley which are: Bonou, Adjohoun, Dangbo, Sô-Ava and Aguegues. This area covers 990 km<sup>2</sup> with an average population density of 418 inhabitants per km<sup>2</sup> (INSAE 2016). The average farm size is 1.60 ha (Codjia 2009). According to Legba (2006), the main economic activities in the lower Oueme valley are fishing, agriculture, livestock, trade, crafts and hunting. Located in south-eastern Benin, it lies between 2°21'2" and 2°36'5" east longitude and between 6°24'5" and 6°58'1" north latitude, as shown in Figure 1.

### Data collection

In this study, the assessment of IWRM implementation is based on the methodology developed by the UN and focuses on indicator 6.5.1 (which represents the degree of implementation of integrated water resources management) of Goal 6 of the Sustainable Development Goals (SDGs) (by 2030, to

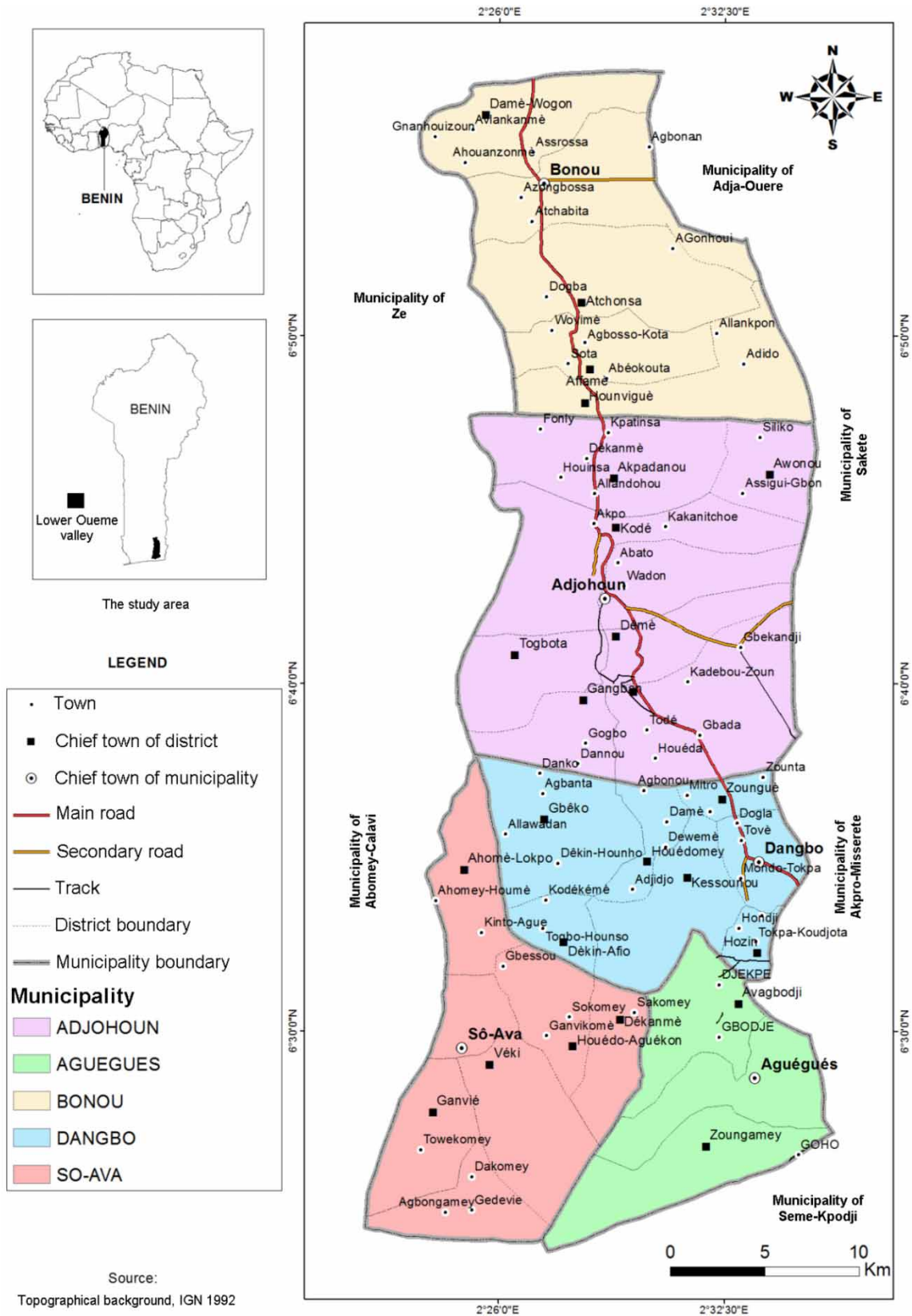


Figure 1 | Presentation of the study environment.

implement IWRM at all levels, including through transboundary cooperation). This methodology is based on a form for assessing the level of implementation of IWRM. This form is composed of several relevant questions which are grouped into four sections, each covering a key component of IWRM:

1. **Enabling environment:** This section deals with the creation of an enabling environment, which is about creating the conditions to support the implementation of IWRM. This includes the basic policy, legal and planning tools for IWRM.
2. **Institutions and participation:** This section discusses the range and role of political, social, economic and administrative institutions involved in implementing IWRM. It includes some of the most important institutions for IWRM at different levels of society. It also includes institutional capacity and effectiveness, cross-sectoral coordination, involvement of various other stakeholders and gender equality.
3. **Management instruments:** This section includes tools to enable decision-makers and users to make rational and informed decisions between different policy options and measures. It includes programmes for managing, monitoring water resources and the pressures on them, knowledge sharing and capacity building.
4. **Financing:** This section concerns the adequacy between the funding available for water resources development and the management of water resources by the different beneficiary entities.

In this study, this form is addressed to the structures and organisations of actors involved in water management in the study area. The technique used to collect data from these families is the semi-structured interview. It was supported by documentary research.

### Documentary research

The documentary research made it possible to take stock of current water resource management and to identify the actors involved in this management. For this purpose, documents were consulted at the General Directorate for Water, at the National Water Institute and in the Non-Governmental Organizations International Circle for the Promotion of Creation, Benin Environment and Education Society, National Water Partnership-Benin. This documentary research was also supported by the virtual bibliography.

### Sampling

The non-probabilistic snowball sampling technique supported by the results of the documentary research made it possible to identify 31 actors involved in water resource management. Data collection using the UN form was mainly carried out among local authorities, decentralised state structures (SDE), civil society associations interested in the preservation of natural resources and users. [Table 1](#) presents a breakdown of the respondents by family of actors.

**Table 1** | Breakdown of respondents by stakeholder family

Actors' families	Stakeholders	Staff	Percentage (%)
Local authorities	Town halls	5	16
Users	Farmer, breeder, fisherman, fish farmer, industrialist, merchant, transporter, tourist, quarry operator and others	12	39
Deconcentrated state structures	Deconcentrated Services Prefecture, Deconcentrated Service in charge of Water, Agriculture, Livestock, Fishing and Environment and others	10	32
Associations of the civil society	Traditional power and religious denomination; NGO Environment/ Sanitation; Other civil society actors	4	13
Total		31	100

Source: Field survey (2018).

The 31 structures that were met or contacted are grouped by families of stakeholders in the study sector are as follows:

- Deconcentrated state structures, the surveys were conducted with ten deconcentrated state structures involved in the study sector:
  - Oueme Departmental Directorate of Energy, Water and Mines
  - Atlantic Departmental Directorate of Energy, Water and Mines
  - Departmental Directorate of Agriculture, Livestock and the Oueme
  - Departmental Directorate of Agriculture, Livestock and the Atlantic Area
  - Regional Direction of Water Company of Benin Oueme/Plateau
  - Forest Inspection Oueme/Plateau
  - Forest Inspection Atlantic/Littoral
  - Departmental Directorate of the Living Environment and Sustainable Development of Oueme/Plateau
  - Departmental Directorate for the Atlantic/Littoral Living Environment and Sustainable Development
  - Oueme Departmental Health Directorate.
- Local authorities:
  - the five town halls of the study area.
- Civil society associations: four grassroots stakeholders were contacted:
  - Association of Drinking Water Users (ACEP)
  - Non-Governmental Organisation (NGO) for the protection of natural resources
  - Communal committee for environmental protection
  - Union Communale des Rois.
- Users:
  - Regional Union of Producers
  - Fisheries Committee
  - Union of Sand Operators
  - Farmer, delegatee of AEP works
  - Group of rice growers
  - Cowherds Committee known as 'Agblanon'
  - Communal Association of Market Gardeners
  - Group of women farmers
  - Union of Hotel Industries
  - Producers of conditioned water
  - Group of fish farmers
  - Civil Engineering Company.

### **Semi-structured maintenance**

The semi-structured interview took place with the representatives of the various actors listed above. For each question a score from 0 to 100 in increments of 10 was given by the respondent according to the level of application of the IWRM aspect addressed.

### **Data analysis**

The score for indicator 6.5.1 is the average of the scores for each section. [Table 2](#) summarises the process of calculating this score.

The score obtained indicates the 'degree of implementation of integrated water resources management', on a scale of 0–100, where 0 indicates no implementation and 100 represents full

**Table 2** | Method of calculating indicator 6.5.1

Section	Average score
Section 1 Enabling environment	Sum of the section scores, divided by the total number of questions in the section
Section 2 Institutions and participation	
Section 3 Management instruments	
Section 4 Financing	
Score for Indicator 6.5.1: Degree of implementation of IWRM	Sum of the average of sections 1, 2, 3 and 4 divided by 4

Source: IWRM data portal (UN) (2017).

implementation. An interpretation according to [IWRM data portal \(UN\) \(2017\)](#) is provided as follows:

- 0–≤10: Very low: the development of IWRM elements has generally not started or has stalled.
- 10–≤30: Weak: Implementation of IWRM elements has generally begun, but with limited acceptance and relatively low commitment from stakeholder groups.
- 30–≤50: Medium–low: IWRM elements are generally institutionalised and implementation is ongoing.
- 50–≤70: Medium–high: Capacity to implement IWRM elements is generally appropriate and elements are generally implemented as part of long-term programmes.
- 70–≤90: High: The objectives of IWRM plans and programmes are generally achieved and the geographical coverage and commitment of different stakeholders is generally good.
- 90–≤100: Very high: The vast majority of IWRM elements are fully implemented, with objectives achieved as defined and plans and programmes are periodically evaluated and reviewed.

## RESULTS

The results of this evaluation are presented by criteria according to the methodology described above.

### Enabling environment

The enabling environment includes the basic policy, legal and planning tools to support the implementation of IWRM in the lower Oueme. According to stakeholders, several policies have been developed since the 1990s. However, these policies are characterised by a moderately low degree of implementation (they are IWRM-based, government-approved and are beginning to be used by the authorities to guide work) in the rating scale. In order to highlight the implementation of IWRM, several commitments and documents have been made. These include the adoption of IWRM and the choice of a vision in 1998, the drafting of the National Water Policy in 2009, the drafting of the Master Plan for Water Development and Management in the Oueme basin and the establishment of the National Water Council in 2013.

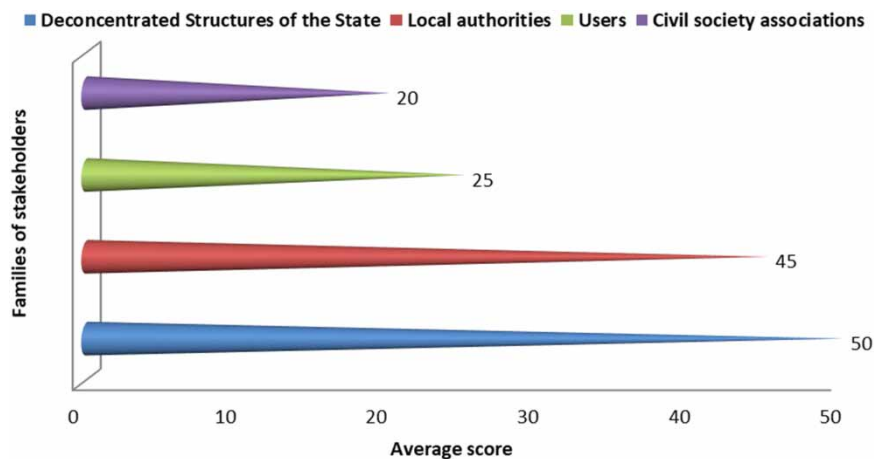
With regard to the legal and regulatory framework for water management, Benin has a significant and diversified legal arsenal relating to the protection and safeguarding of natural resources. These legal instruments are regularly reinforced by provisions adapted to the international commitments made by the country and to the evolution of the socio-economic and cultural framework ([GWP 2009](#)), the content of which is regularly updated. Analysis of this legal and regulatory framework

reveals that it has long been governed by Law No. 87-616 of 21 September 1987 on the Water Code in the People's Republic of Benin.

The serious imperfections of this Water Code led the Government to propose a general reform of the legislation and to have it adopted and promulgated Law No. 2010-44 of 24 November 2010 on Water Management in the Republic of Benin to replace the said Code which sets out the principles relating to the management and special protection of water, specifies the legal status and regime of water, defines the institutional framework and public interventions in the sector, planning and financing instruments, prospective and penal provisions (BEPP 2012). According to the same source, this law aims to put an end to purely sectoral management, which is highly centralised, inefficient and does not preserve water resources in their multiple social, economic and cultural dimensions.

However, even if the country's legal arsenal is quite extensive, there are problems of implementation. Moreover, almost all of the actors surveyed report that the legal texts are not respected and that they are poorly publicised. According to these actors, the degree of implementation of national laws on water resources is moderately low. These laws exist but are not enforced. As for the National Action Plan for Integrated Water Resources Management, it has been drawn up for the period 2011–2025 and has been adopted by the Government. It is currently in its second phase of implementation, but the effects are hardly noticeable.

Figure 2 presents the result of the evaluation of the 'enabling environment' section by the different families of stakeholders.



**Figure 2** | Evaluation of enabling environment according to the families of stakeholders. *Source:* author.

The level of implementation of the 'favourable environment' section varies according to the families of actors interviewed. Civil society associations and users consider that the environment is weakly favourable to the implementation of IWRM. The scores given are 20 and 25, respectively. On the other hand, local authorities and decentralised state structures give scores of 45 and 50, respectively. According to them, even if there is still work to be done, efforts are perceptible for the favourable environment in the implementation of IWRM.

Thus, based on the opinions of the respondents, the 'enabling environment' section obtains a rating of 35 for this evaluation. As a result, the political, legal and regulatory framework is weakly favourable to IWRM.

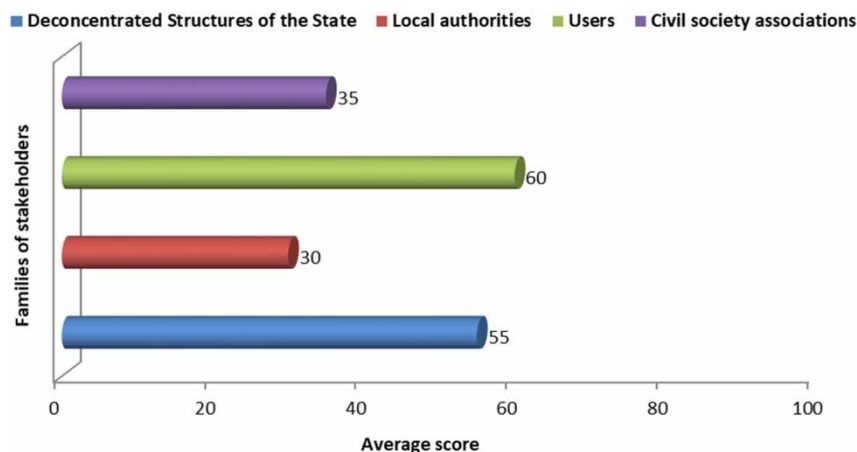
### Institutions and participation

The institutional framework for water resource management is made up of numerous actors at both national and local levels. It includes public sector actors, including in particular the ministries

concerned with water management, local authorities and, finally, private sector actors through their various services. Several consultation bodies have been set up for this purpose. At this local level, we can mention the Oueme Basin Committee set up in December 2016. Composed of crowned heads, religious leaders, heads of decentralised state services, civil society actors, farmers, fishermen, stock-breeders, its mission is essentially to lead the IWRM of the Oueme basin. It should also be noted that at the national level, there is the National Water Council, which is the first structured mechanism at the national level and which brings together all categories of public and private stakeholders concerned by the sustainable management of water resources.

The institutional framework is therefore well defined and is favourable to IWRM. The attributions of the different actors (decentralised state structures, local authorities, civil society, users) are established. Meetings of the Oueme Basin Committee are held once a year, but it is difficult to monitor the implementation of the decisions taken. The main observation is that the anchoring and implementation of these various frameworks are not well implemented in the field. Figure 3 presents the result of the evaluation of the ‘institutions and participation’ section by the different families of stakeholders.

The results of the evaluation of the ‘institutions and participation’ section vary according to the families of stakeholders interviewed. Civil society associations and local authorities consider the range and role of political, social, economic and administrative institutions involved in implementing IWRM to be medium–low. The scores given are 35 and 30, respectively, but users and decentralised state structures gave scores of 60 and 55, respectively. They consider that although there are still aspects that need to be improved, the institutions involved in implementing IWRM in the study area are playing their role.



**Figure 3** | Evaluation of institutions and participation according to the families of stakeholders. *Source:* author.

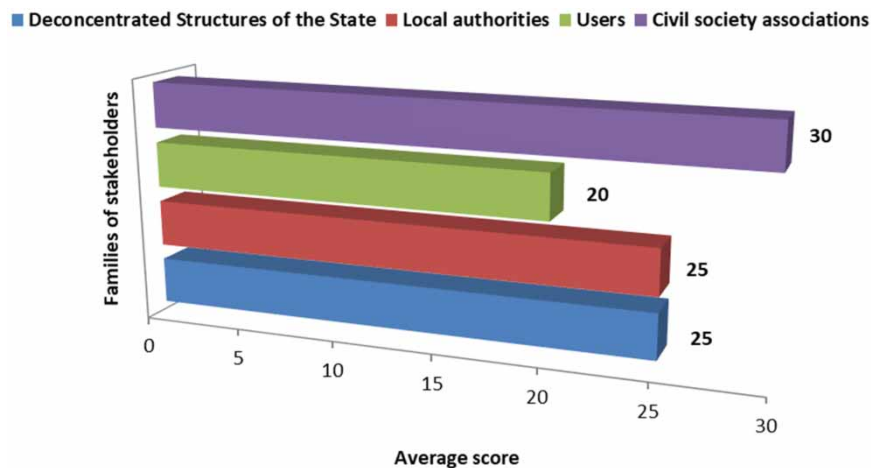
Overall, stakeholders’ responses to the different headings in this section credited it with a score of 45 on a scale of 0 to 100. The institutional framework is therefore moderately favourable to water resource management.

### Management instruments

Insufficient instruments or tools to enable decision-makers and users to make rational and informed decisions between different options and measures for action make it difficult to manage water resources sustainably in the study area. Indeed, the level of knowledge of the resource remains low to the point where the available information is insufficient to allow good planning of actions. Moreover, the most advanced technical instruments (modelling, satellite imagery, technicality of water analysis laboratories) are not yet used on a daily basis and are only mastered by a small number of



managers, generally at university level. Although on surface waters, the basic network of about ten stations centred on the Oueme and the main rivers has become denser and has extended over the years to water bodies, periodic reports on the state of the resource are sporadic before disappearing since 2008 (Ministry of Water 2015). This does not facilitate continuous monitoring of the resource in order to make the necessary projections and analyses to better plan water use and anticipate risks and disasters linked to climate change in the basin. Figure 4 presents the situation of the ‘management instruments’ section by families of stakeholders.



**Figure 4** | Evaluation of management instruments according to the families of stakeholders. *Source:* author.

The analysis of Figure 4 shows that all the actors have approximately the same perception of the ‘management instruments’ section. In fact, civil society associations gave it 30 points, the decentralised structures of the state and local authorities 25 points and users 20 points. Thus, the opinions of the families of stakeholders show that much effort remains to be made to improve the implementation of IWRM with regard to this indicator.

This lacklustre picture painted by the stakeholders questioned explains the score of 25 on the 0–100 scale obtained by this section and denotes the low level of IWRM implementation for this criterion.

## Financing

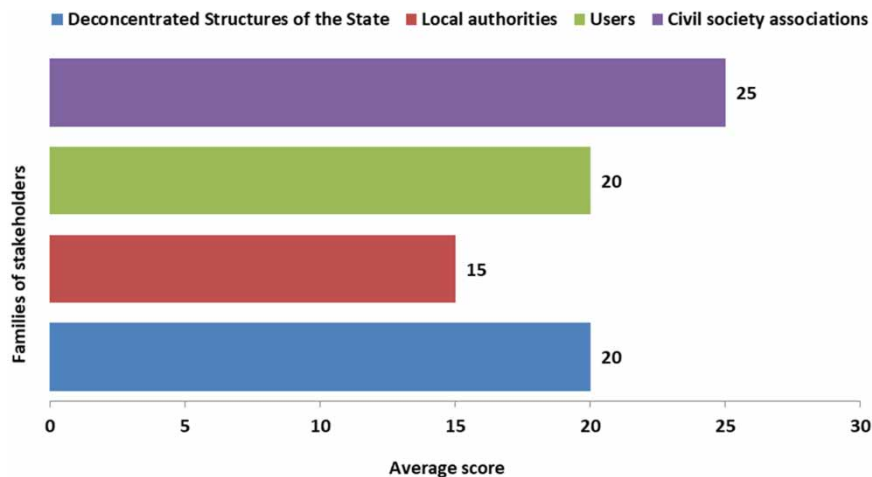
There is some lack of funding to cover all aspects of water resources development and management. Indeed, concerning the economic and financial aspects, some funding has been mobilised for the implementation of certain actions. The non-exhaustive financing is as follows:

- Dutch funding obtained through the OmiDelta programme;
- German GIZ funding obtained through KfW;
- Funding from the World Bank, WAEMU, ADB.

This funding is generally disparate and poorly coordinated, which does not facilitate the prioritisation and pooling of actions for better water resource development and management. Also to be deplored is the low rate of budget consumption and a lack of harmonisation between actual expenditure and forecasts.

However, the financing of the water sector in Benin remains partly dependent on external aid. Over the period 1993–2004, the drinking water supply and sanitation sector benefited from investments totalling CFAF 65.22 billion, 76% of which was financed by development partners and 24% by the national budget (BEPP 2012). If the resources transferred to the communes increased from 600

million to 2.6 billion between 2013 and 2014, it is the fact of a single external partner. This dependency is a weakness, since if this partner withdraws for one reason or another, the sector is on the ground. Moreover, we note the existence of a single tax, namely, the general tax on consumption which, in reality, is an unallocated tax (Ministry of Water 2015). This funding is more oriented towards drinking water supply, and unfortunately does not cover all aspects of IWRM. Yet, the sector can be self-financing if a good policy for collecting and managing charges from users and polluters of water resources is put in place. Figure 5 shows the evaluation of the ‘financing’ section according to the families of stakeholders.



**Figure 5** | Evaluation of financing according to the families of stakeholders. *Source:* author.

The level of implementation of the ‘funding’ section is generally low according to the families of stakeholders interviewed. They think that there is not a good match between the funding available for the development of water resources and the management of these resources by the different beneficiary entities. This is why the civil society associations gave a score of 25 for this section, the decentralised state structures and users gave a score of 20 and the local authorities gave a score of 15.

This explains the lowest score of 20 on the scale from 0 to 100 obtained by this section after the exchanges with the actors.

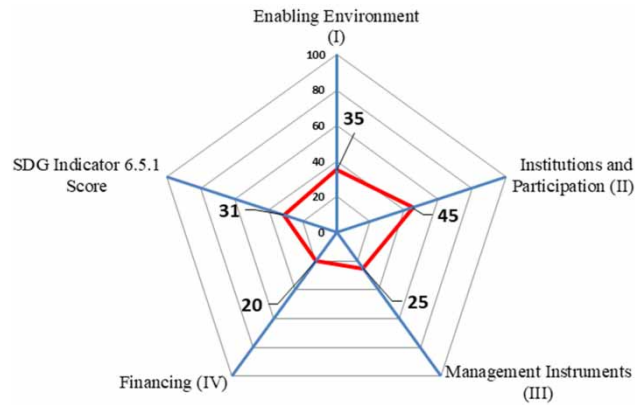
### Summary of the evaluation

The synthesis of the evaluation highlights a number of weaknesses in the current water resources management system, including the low level of funding, the inadequacy of management instruments and the low level of implementation of policies and regulations.

In addition, it reveals an average score of 31 for the degree of implementation of IWRM in the study sector, which reflects a medium–low degree of implementation. Thus, in the lower Oueme valley, IWRM elements are generally institutionalised and their implementation is ongoing. Figure 6 presents the synthesis of the assessment of sustainable water resource management.

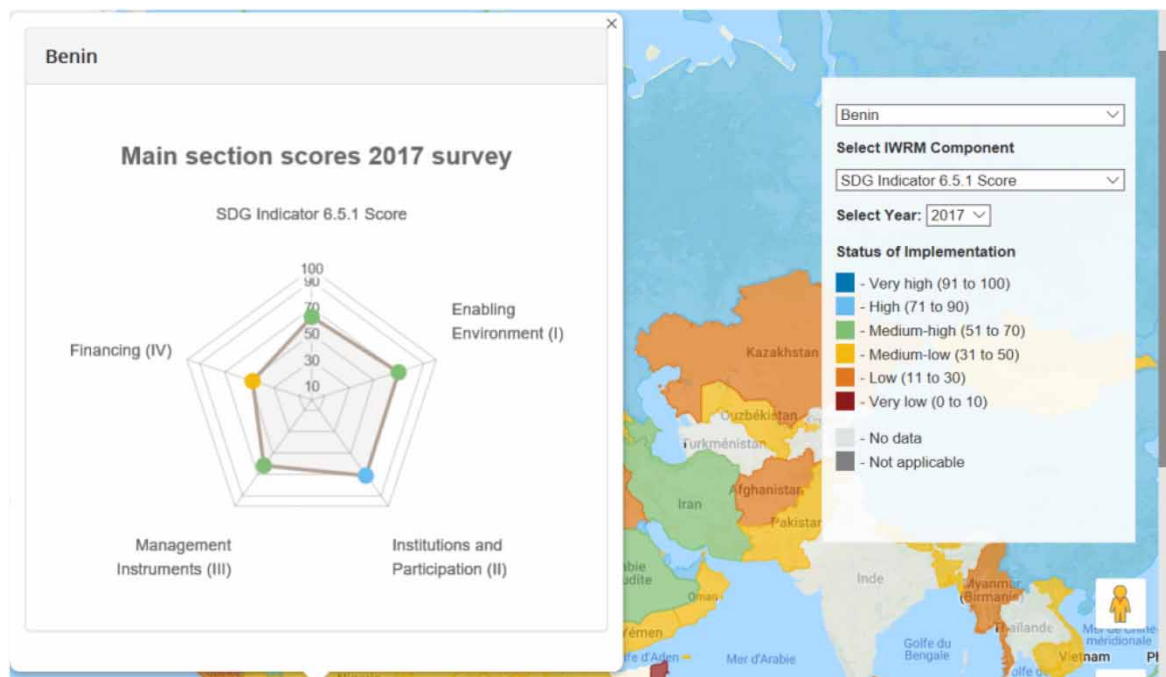
## DISCUSSION

The assessment of the degree of implementation of IWRM in the lower Oueme valley provided an overview of the management of this resource. Although the public and private sectors as well as civil society are involved in this management process, the results are not satisfactory as they reveal that



**Figure 6** | Evaluation of IWRM implementation in the lower Oueme valley.

sustainable water resource management is not yet well implemented in the lower Oueme valley. Indeed, the score obtained for the indicator reflecting the degree of implementation of IWRM is 31. This value is slightly below the national average (score of 35) obtained in the same year (2018) by the Ministry of State in charge of Planning and Development. However, these scores are between 30 and 50: an interval corresponding to a medium–low degree of implementation. As a result, the results of this study are similar to those of the [Ministry of Planning and Development \(2018\)](#) and lead to the conclusion that the elements of IWRM are generally institutionalised and their implementation is ongoing in the lower Oueme valley. Furthermore, according to the UN IWRM data portal, the main scores for Benin in 2017 for SDG indicator 6.5.1 were somewhat more optimistic. The overall score was 63 ([Figure 7](#)). With reference to the results of this study and those of the Ministry of Planning and Development, this score does not reflect the realities of the sector under study.



**Figure 7** | Monitoring indicator 6.5.1 of SDGs in Benin. *Source:* IWRM data portal (UN) (2017), [www.iwrmdataportal.unepdhi.org](http://www.iwrmdataportal.unepdhi.org).

## CONCLUSIONS

At the end of this study, it appears that IWRM implementation in the lower Oueme valley has generally started at national level, but with limited acceptance through weak engagement of stakeholder groups, as confirmed by the results of the UN form-based assessment tool. Indeed, most of the policies and laws within this management framework are based on IWRM, and although approved by the government, it is only just beginning to be used by the authorities to guide the work. Similarly, the number of documents (laws, strategy, decree, action plan) is not negligible, but they suffer from a lack of popularisation and application. Also the mechanisms for monitoring quality and the levies taken annually to cover the needs of the various branches of activity are insufficient, as is the funding to cover all aspects of development and IWRM. However, it should be noted that this is a dynamic process and that it will be necessary to keep pace in order to meet the SDGs in 2030, which will make it possible to meet the needs of the different uses of water resources while limiting the impacts of these activities in the context of climate change. This is why Valipour *et al.* (2020) have shown that understanding the trends of reference evapotranspiration and its influential meteorological variables due to climate change is required for studying the hydrological cycle, vegetation restoration and regional agricultural production. Hence, climate change is an important parameter to take into account in IWRM assessment. Further research may, on the basis of this study, replicate the evaluation in other settings. This will enable a comparative analysis to be made for sustainable development actions.

## DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

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