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ORGANIZATIONAL AND TECHNICAL CONSTRAINTS OF THE MANAGEMENT OF HYDRAULIC STRUCTURES IN THE COMMUNES OF BONOU AND ADJOHOUN IN BENIN

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ABSTRACT

The governance of water resources in developing countries (DCs) and in Benin in particular is undoubtedly a major political, economic and social issue for governments and international institutions. The objective of this research is to analyze the organizational and technical constraints of the management of water access structures in the Communes of Bonou and Adjohoun.

The methodological approach used is based on the collection of qualitative and quantitative data. The collection techniques are documentary research and semi-structured interviews. The principled choice method was used to select 270 respondents. The data collected were processed and analysed with the appropriate techniques with the help of statistical protocols

From the analysis of the results, it appears that the management of structures is confronted with several constraints, both organizational and technical. According to 67% of respondents, the changes that have taken place in the management of the structures have led to the loss of interest of the population because they have caused shortfalls for the management associations. Similarly, they have caused additional costs in the management chain of structures, according to 83% of respondents. This has as a corollary the high cost of water at the pump. To remedy this situation, 49% say they only use water from structures seasonally. Added to this constraint is the non-availability of spare parts and the lack of skills of repair craftsmen; all of which inhibit the resource development actions that have been put in place for several years.

Keywords: Constraints, Management of structures, Commune, Bonou, Adjohoun.

1. INTRODUCTION

Water and sanitation are essential elements of life and their acquisition is still problematic in African societies, particularly in West Africa. The issue of water poses a double challenge, both for the sustainable management of resources and for access for poor populations (Kamgho B. M, 2010, p. 1). Water is a strategic source whose control is a key to sustainable development. It is a source of life whose importance for both flora and fauna is undeniable, so water is the main constituent of living beings. The world's demand for water is growing faster than the increase in water population : House hold agriculture, industry...(Baechler, L. 2012, p. 7). Energy

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production is also taking up an increasing share of available resources as climate change puts new pressures on agricultural practices locally (Nassopoulos, H., 2012, p. 37).

Access to safe drinking water and sanitation is a daily struggle for hundreds of thousands of urban dwellers, mainly in developing countries. In fact, of the 7 billion people on the planet today, 26% do not have access to sufficient quality water, and 50% do not have an adequate sanitation system (Bouchrit, R, 2008, p. 9). Every day, 20 000 people, mostly children, die from water-related diseases, the equivalent of Nagasaki or Hiroshima every three days (Rouissat B. , 2010, p. 3). This situation is more dramatic in developing countries in sub-Saharan Africa, which have been marked by strong urbanization in recent years as a result of exponential population growth.

In Benin, although not particularly critical, the drinking water situation still requires a certain vigilance on the part of national decision-makers in this sector. It distinguishes two main aspects: the construction of hydraulic structures and the strategy of their management. Effective management must encompass all stages of the water cycle, taking into account their interdependence and the very uniqueness of water resources (Baron and Bonnassieux, 2013, p. 3). In the area of the mobilization and distribution of drinking water, the efforts undertaken during the current decade have made it possible to record significant improvements. Significant progress has been made in improving access to water, but it is not guaranteed. Solutions must be found that will accelerate progress and ensure that no one is left behind. Factors such as improving policy and governance, increasing available funding, modernizing infrastructure, and strengthening data quality to better inform decision-making are critical to implementing solutions (United Nations 2023, 1). The objective of this research is to analyze the institutional and organizational constraints of the management of water access structures in the Municipality of Bonou and Adjohoun

Presentation of the study environment

Located in the department of Ouémé, the duopoly of Adjohoun and Bonou are located between 6°37' and 6°57' north latitude and between 2°24' and 2°35' east longitude. They are bordered to the north by the Commune of Ouinhi, to the west by the communes of Zè and Akpro Misséreté, to the south by the Commune of Dangbo and to the east by the Communes of Sakété and Adja-Ouèrè (Figure 1).

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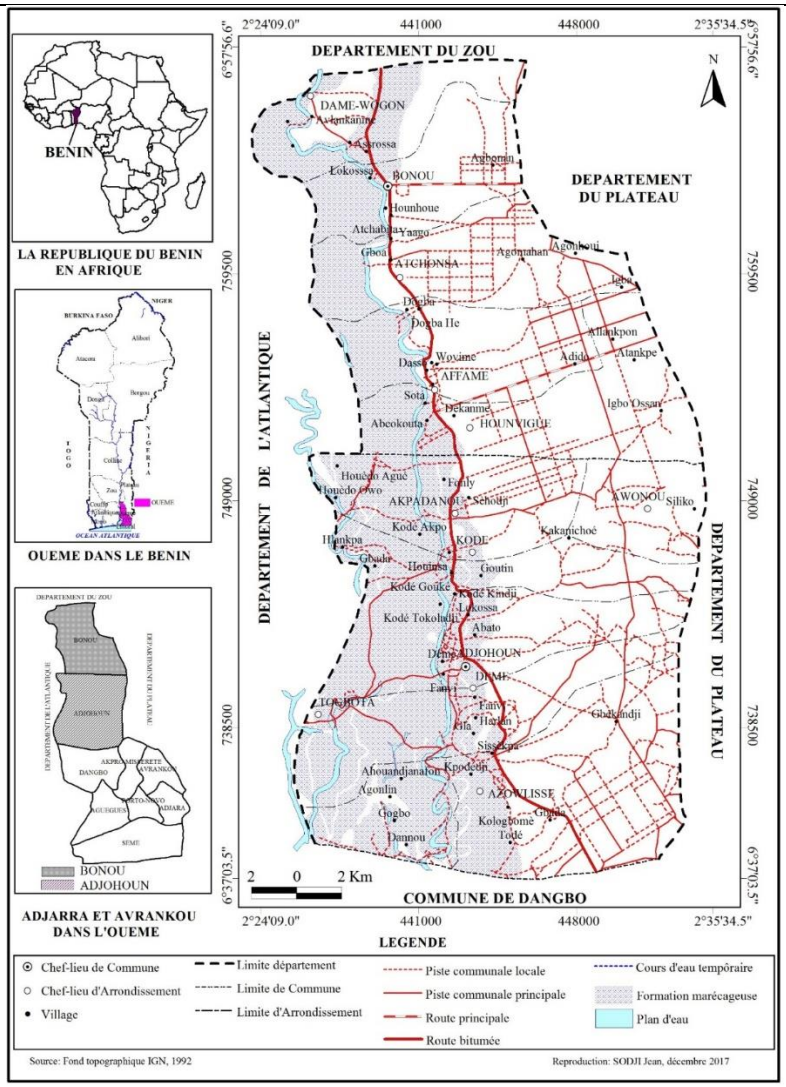

Figure 1: Geographical location of the Communes of Adjohoun and Bonou

The two communes cover an area of 558 km2 (INSAE, 2004). In terms of climate, the duopoly of Bonou and Adjohoun, due to their geographical location, enjoys a sub-equatorial climate with an average annual rainfall of 1300 mm. The climate is characterized by two rainy seasons from March to mid-July and from September to November, alternating with two dry seasons from December to February and from mid-July to August (Figure 2).

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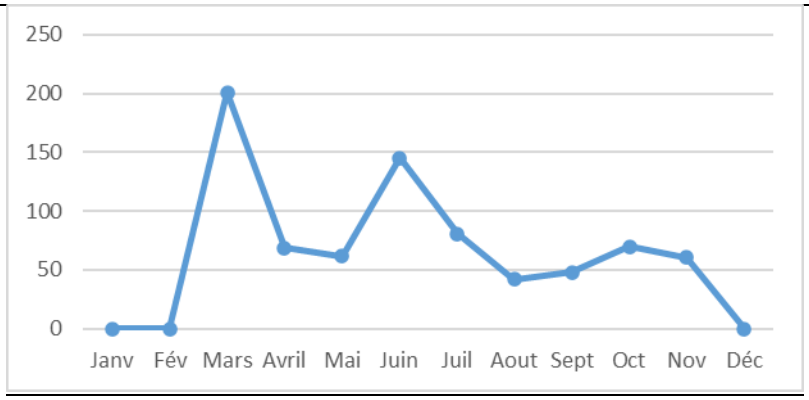

Figure 2: Rainfall pattern in the Ouémé valley

Source, ANM, 2022

Demographically, the population of the Commune of Adjohoun has undergone a remarkable evolution between 1992 and 2013; It has grown from 51301 to 75325 inhabitants. The most populous districts of the Commune of Adjohoun are respectively Azowlissè (22,057 inhabitants), Gangban (15,602 inhabitants), and Adjohoun (10,423 inhabitants). As for the Commune of Bonou, the demographic evolution follows the same trends. The population increased from 24,733 in 1992 to 29,656 in 2002 and 44,349 in 2013. The district of Bonou (12,061 inhabitants) is by far the most populous in the Commune of Bonou.

2.METHODOLOGICAL APPROACH

The methodological approach used in the present study consisted of data collection, processing and analysis of the results.

The data used are mainly statistics on the number of drinking water supply facilities available in the districts/villages collected from the Departmental Directorate of Hydraulics of Ouémé. The latter are supplemented by information from field investigations. Demographic and socio-economic data relating to the size of the population and its activities (agricultural, industrial and other) in the study setting. Statistics from the 1992, 2002, 2013 General Population and Housing Censuses (RGPH) and the 2016 population projection calculations (updated data). Socio-economic data relate to the method of purchase/sale of water, the management of supply facilities and the drinking water needs of the population.

All of this data was collected using data collection tools such as questionnaires sent to the population and point managers, interview guides sent to resource persons and observation grids to document the findings made in the field.

The field surveys were carried out in the two (2) communes (Bonou and Adjohoun). Taking into account the available resources, seven districts, i.e. four in (04) arrondissements in the commune of Adjohoun and three (03) arrondissements in the commune, and in Bonou. The choice of households was based on the following criteria:

- be a family made up of at least father-mother-children
- have a minimum of three (03) members in the household;
- have access to at least two different water sources;

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- have resided in the municipality for the last five (05) years;

Sample size was determined using the probabilistic method of Schwartz (1995).

$$\mathbf{X} = ;(\mathbf{Z\alpha})^2 \times \mathbf{p}\,(\mathbf{1}-\mathbf{p}))/i^2$$

with:

- X = sample size;
- $\mathbf{Z\alpha}$ = reduced deviation corresponding to a sampling rate of 95% (= 1.96);$\mathbf{Z\alpha}$
- p=n/N; where p=proportion of selected households (n) in relation to the total number of households (N) in the study setting;
- i = desired accuracy equal to 5%;

A total of 270 households were visited in the target municipalities, in addition to 16 resource persons made up of infrastructure managers, local authorities and TFPs, development groups or associations, etc.

The SWOT analysis model was used for both external and internal analysis by highlighting the positive and negative factors of the entity or system under study.

Applied to all the results obtained in this study, the SWOT analysis model made it possible to establish two diagnoses in relation to the management of water infrastructures. These are:

- An external analysis that identifies opportunities/opportunities and threats in water governance in the context of decentralization. These are factors external to water governance in the context of decentralization that have positive or negative effects on the supply of drinking water to populations in the study environment;
- An internal analysis that identifies the strengths and weaknesses (strengths and constraints) of water governance in the context of decentralization in the study environment. These are internal factors that contribute to or hinder good water governance in the context of decentralization in the study environment.

3. RESULTS AND DISCUSSIONS

Access to drinking water in the municipalities of Bonou and Adjohoun

Several drinking water supply facilities are operated by the communities of the target municipalities. These are between AEVs connected to the standpipes (BF) of the Autonomous Water Stations and the large diameter wells.

Borehole equipped with Human Motor Pump (MPF)

The borehole equipped with a Human Motor Pump (FPM) has been the work par excellence of rural hydraulics since the mid-seventies (1970). An FPM is considered a water point (WHP) and must therefore serve a maximum population of 250 inhabitants. Photos 1 and 2 show the two types of FPMs used in Abéokouta in the Commune of Adjohoun.

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Photo 1: *Human-powered drilling carried out by the CGC-Benin association*
Shooting: Sodji, April 2017

Photo 2: *Human-powered drilling conducted by Global Aid Network Canada*
Shooting: Sodji, April 2017

According to field surveys, FPM boreholes are used by 32.46% of households in the two communes. A total of 89 FPMs were identified, 14 of which were non-functional and spread over seven out of eight districts; only the district of Togbota (Commune of Adjohoun) does not have an FPM. The borehole in photo 1 was carried out by CGC-Benin, a local association, while the second FPM was carried out by Global Aid Network, a Canadian organization, in association with the Government of Benin. The difference between the two structures is clear from the point of view of the structure and the quality of the equipment used for the construction. As a result, Global Aid Network's drilling looks more resilient than CGC-Benin's drilling.

AEV

The AEV usually consists of a borehole equipped with a motorized pumping system connected to a storage tank called a water tower and a water distribution network. AEVs are a good solution for the supply of drinking water to large villages with a total population of more than 2000 or for groups of villages and localities close to each other (DG-Eau, 2008). The water from the AEVs is distributed through underground pipes by means of standpipes (BF) and special connections. The following photos illustrate some fountains connected to the AEV and water tower in the study environment.

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Photo 3 : Standpipe (BF) in Dogbahoué, Bonou Commune
Shooting: Sodji, April 2017

Photo 4 : Standpipe (BF) in Agonhoui, Bonou Commune
Shooting: Sodji, April 2017

Photo 5: AEV storage tank (water tower) in Lowé, Commune of Adjohoun
Shot: Sodji, March 2017

Photo 6: AEV storage tank (water tower) in Dogba, Adjohoun Commune
Shot: Sodji, March 2017

According to surveys, 48% of the population in the study setting uses water from AEVs. The municipalities have several AEVs located in the arrondissements and water is distributed via standpipes in the arrondissements.

Autonomous Water Station (PEA)

The Autonomous Water Station (PEA) consists of a borehole or a well equipped with a motorized pumping system connected to a storage tank. The water is distributed directly at the foot of the reservoir through a ramp with taps and this water must then be transported to the places of consumption by the users. PEAs are perfectly justified and profitable in very dense housing areas: at least 1000 people in group housing, i.e. four (4) water point equivalents. Photos 3 and 4 show some PEAs in Adjohoun.

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Photo 7 : An autonomous water station (PEA) connected to the AEV in Gbada, Commune of Adjohoun
Shooting: Sodji, April 2017

Photo 8: A modern autonomous water station (PEA) connected to the AEV in Gouti, Commune of Adjohoun
Shooting: Sodji, April 2017

Despite the significant use of this category of structure and the large number of people it serves in drinking water, DG-Water considers that the construction of the majority of these structures does not comply with the relevant construction standards, the hygienic conditions and the quality of the water distributed are also questionable.

Constraints related to the management methods of the structures

Over the past thirty years, the management of structures in Benin has undergone reforms in order to better manage the resource. Indeed, as part of decentralization, new institutional arrangements for the management of drinking water access infrastructure are being implemented in Benin. The principles on which they are based are, for village water supply (AEV) and boreholes equipped with human-powered pumps (FPM), delegation to private operators.

In the light of the International Decade for Water and Sanitation (DIEPA) initiated by the United Nations at the end of the 1980s, to ensure the supply of safe drinking water and sanitation to underserved urban and rural areas, a community-based management system, the management methods varied according to the type of structure. The MPFs were managed by management committees composed of representatives appointed at an assembly by the users to whom they were accountable. For complex structures such as AEVs, management was organised by water users' associations (WUAs), which were in principle representative of the users of standpipes (Hounmenou, 2006). A great deal of autonomy was conferred on these associations, even including ownership of infrastructure. In 2006, a study by the Directorate-General for Water (DGEau) revealed several irregularities in the management of the structures. They concern cases of embezzlement of funds as well as the maintenance of structures. To alleviate this situation, and on the instructions of donors, who contribute to 75% of investments in the sector, it was decided to delegate the public water service to farmers. In this strategy, the farmers are the managers of the water points but the municipalities become the owners of the equipment and the project owners. Thus, leasing to private operators is particularly recommended for complex infrastructures, such as AEVs, given the high cost of equipment and the high costs associated with its operation and maintenance. This situation transforms people from the status of co-managers to that of consumers. The change thus made is not to the liking of the populations who

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feel that they do not control the distribution of water. Similarly, it deprives the EUAs of important sources of income because it moves from a manager to a simple drinking water consumers' association (ACEP) whose role is limited to monitoring compliance with contracts.

The transition from community management to delegated management is not well received by the heads of the organizations because, according to surveys of resource persons, 72% say that this situation leads to a loss of income for the beneficiary populations, especially in localities where the management of water infrastructure generated surpluses. The profits derived from the management of hydraulic structures or collective works in general were one of the main means of financing equipment for the benefit of the community. These profits were also used to feed a chain of social solidarity not provided for in the texts (loans, reception of notables, organization of village ceremonies, etc.). All these advantages have disappeared with delegated management and the water sector is no longer of particular concern to the population. Added to this is the fact that delegated management recommends that the manager be a person from outside the village. As a result, the notables who decided on the distribution of these sums were dispossessed of the power that this gave them. All these situations make the beneficiaries believe that they no longer have an interest in paying attention to the management of the works.

Constraints related to the transfer price of water

In the context of decentralisation, the users' organisations no longer decide on the price of water, which is the result of a lack of transparency between the municipality and the farmer. The cost price is known only by the decentralised water service, the municipal water service agent and the mayor (Antea/Cidr, 2009). Municipalities are tempted to increase the price of water in order to increase the fees they collect in order to repair faulty infrastructure and feed the municipal budget. Rising water prices are an opportunity for farmers to increase their margins. The mention of resistance to infrastructure leasing shows that it is not so much the change in infrastructure management methods that gives rise to tensions between the actors involved in it as the control of the management of the funds that come from the sale of water.

The changes that have taken place in the sector of water service management in the communes of Adjohoun and Bonou have led to an increase in the price of selling water to consumers. Indeed; For example, the transition from community management to delegated management of the works has led to new items of expenditure, according to the explanations of former members of the WUAs. The transfer price per cubic metre, for example, at the level of AEVs, has risen from 250 F during Community management to 330 F during delegated management. This same quantity is sold at 450 F at the level of private connections. However, it should be noted that in the community management system of the FPMs that prevailed before the transfer of the sector, the delegation of the management of the works, the payment of water was not systematized. Indeed, in some villages, due to the growing poverty of the population, many families are unable to pay for water; To maintain social cohesion and avoid creating tensions between villagers, the CPE allows them to serve themselves free of charge.

Similarly, according to 65% of the population, during the period of community management, the transfer price of the 30-litre basin was 10 francs. As a result of the delegation to a farmer and the new municipal levies, the basin is now sold for 25 CFA francs, i.e. an increase of 150% in the sale price. Thus, according to (Antea/Cidr, 2009), the increase in the price of water, which occurs

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with leasing systems, is an argument used to contest the transfer of the management of drinking water access systems to private operators. The increase in the price observed in the price of water transfer since the advent of delegated management has led some of the population to use AEVs and FPMs only in the dry season, when other water sources were in short supply. This strategic choice of this frank of the population concerns above all drinking water.

The other important constraint of water management is also the seasonal consumption of water. According to field surveys, 95% of people emphasize that they only get their supplies from the BF and FPM during the season because during this period, most of the traditional structures, the structures for collecting runoff water from roofs and backwaters dry up. This forces them to rely on conventional structures. Thus, in the dry season, FPM and BF are heavily solicited, given the decrease in water resources in traditional wells and backwaters. This seasonal consumption of water from conventional structures means that farmers are sometimes forced to close during this period.

Geographical constraints

Accessibility is a concept that reflects the degree of ease with which a service can be accessed. Accessibility here translates into the average distance between households and their drinking water supply. Figure 3 shows the distance between drinking water points and homes.

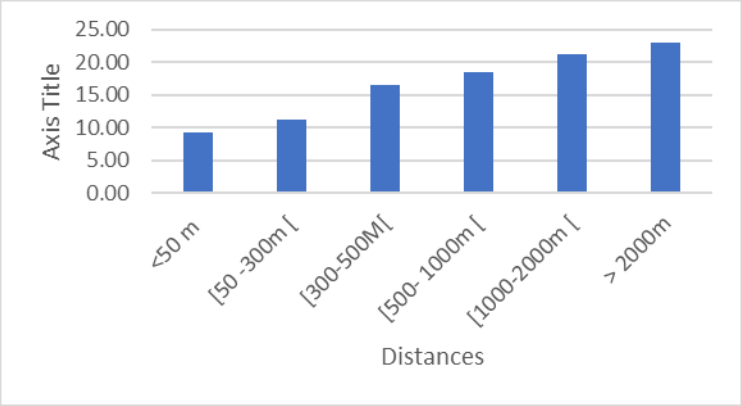

Figure 3: Distance from the water point to the house
Source: 2019 survey results

From the analysis of the data, it appears that about 40% of households travel between 500 and 1500 mm to obtain drinking water. The average distance between households and their drinking water supply point is 330 m. About 23% of households travel more than 2 km to get their water. Comparing this average distance with the WHO standard (200 metres), it can be said that the accessibility of households in the two municipalities to drinking water supply points is not easy. Thus, one of the difficulties encountered by the populations is the significant distance they travel to obtain drinking water. They waste a lot of time, especially the women, because they do the water chores. This makes them vulnerable as they will have little time to take care of their income-generating activities.

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Technical constraints

The technical constraints, most of which are related to the type of work installed in the localities and the availability of spare parts and the skills of the repair craftsmen. These constraints vary depending on the type of structure and the models installed. According to 87% of surveys, hand pumps have been the source of many problems encountered by water point users for years. In reality, 45% of these structures have broken down in recent years and their maintenance takes quite a long time. It took more than a year for some to be repaired, for others; The repair was not possible and it was necessary to completely change the entire power supply system. The main cause of these breakdowns is the unavailability and poor quality of spare parts. This increases the frequency of outages, which constantly send women back to the backwater and bodies of water. These problems refocus the question of the training of well-diggers and repair craftsmen who are often not available to carry out the maintenance of the structures. Indeed, the problem of the competence of the maintenance and management of the management committees had already been revealed in the evaluation reports on the situation of the FPMs and the AEVs in Benin, where the deficiencies in the maintenance and management skills of the community bodies are invoked to justify the attribution of management to private actors. The failure to take into account the lack of maintenance skills of managers and the lack of control over the content of the governing contracts are widely mentioned by managers as being one of the major constraints in the management of structures.

4. DISCUSSION

The availability and access to water by the populations of the communes of Bonou and Adjohoun are subject to many constraints. They are technical, organizational and financial. Indeed, the transition from community management to delegated management is not well received by the heads of the organizations. This passage has resulted in a loss for both the management committees and the population. In localities where the management of water infrastructure generated surpluses. The profits derived from the management of hydraulic structures or collective works in general were one of the main means of financing equipment for the benefit of the community. According to (Bonnassieux A. and Gangneron F, 2011); This change is not well received by the leaders of community organizations in localities where the management of water infrastructure generated surpluses. It deprives local communities of substantial monetary resources. Within these organizations and the villages, the notables who decided on the distribution of these sums were dispossessed of the power that this gave them.

In rural areas, where the level of monetary resources is limited and where the majority of the inhabitants are poor, the sums derived from the management of collective infrastructures managed by community bodies (livestock markets, self-managed cotton markets, input shops, etc.) constitute one of the main means of financing equipment for the benefit of the population. In Benin, as well as in other countries in the sub-region, when water infrastructure is managed by community authorities, part of the sums from the sale of water are reallocated to contribute to the establishment and equipment of collective infrastructures, or, as in the case of the FPMs studied in Hombori in Mali (Gangneron; F et al., 2010), to organise receptions for dignitaries, to lend to acquaintances in need, or to relatives in order to maintain networks of solidarity(Ndione S.E., 1994). This redistribution of cash sums for social purposes, which is not provided for in the normative management frameworks, makes sense and is accepted at the local level.

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Sub-prefects and elected officials at the communal level in Benin and elsewhere in the subregion, taking advantage of their position, have frequently drawn on the coffers of community organizations to finance expenses that had nothing to do with the maintenance of water infrastructure.

The changes that have taken place in the sector of water service management in the communes of Adjohoun and Bonou have led to an increase in the price of selling water to consumers. Indeed; For example, the transition from community management to delegated management of the works has led to new items of expenditure, according to the explanations of former members of the WUAs. The studies of (Bonnassieux A. & Gangneron F, 2011b) This change in management methods leads to an increase in the price of water with three new items of expenditure: the operator's remuneration, that of the operator and municipal taxes. It goes from 330 FCFA per m3 in the former AEV to 500 FCFA at the BF and to 580 FCFA for the twenty or so private connections. This increase is causing dissatisfaction among users who note that water is much more expensive than in the city of Djougou where the m3 of water distributed by SONEB is sold at the subsidized rate of 198 FCFA corresponding to the first tranche.

The increase in the price of water reinforces a tendency to use LWDs only in the dry season, when other water resources are lacking.

Similarly, consumers, given the high cost of transferring water, are forced to readjust the use of water from conventional sources by opting for the use of the latter during the dry season, a period when non-conventional water sources are scarce. (Bonnassieux A. and Gangneron F, 2011a)believes that it is the transition from community to delegated mode which, as far as domestic water is concerned, means that many users have quantitative management (access to the nearest water point at the lowest cost) and not qualitative management (access to safe water). Indeed, during the rainy season, whether before or after 2008, the distribution to the BFs is so low that some close, with populations turning mainly to wells and even surface water. It is only in the dry season, when the wells dry up, that the AEVs are operating at full capacity.

The management capacity of associations, suspicions of embezzlement and the incompetence of repair craftsmen are also the constraints that hinder the effective management of the works. Added to this is the unavailability of spare parts, which leads to high failure and abandonment rates at the level of the municipalities. These results had also been identified by xxx who believe that in the evaluation reports on the situation of FPMs and AEVs in Benin, the deficiencies in maintenance and management skills of community bodies are invoked to justify the attribution of management to private actors. These findings of deficiency were partly predictable. The management of the FPM and AEV has been given to the users' representatives without careful reflection or sufficient consideration of social relations (age groups, social relations of gender, hierarchies between lineages and between social groups), local representations of water and the diversity of norms e The obligation to write and keep accounts means leaving room for those who have completed a formal education, rather young people. This involves depositing money at the CLCAM, whereas normally it circulates, thus ensuring multiple social functions. As for the technical skills needed to maintain the system, they were and still are rare endogenous to its management (Sall M. et al., 2010).

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5. CONCLUSION

The resource management sector is a very sensitive sector with regard to the multiple and competing uses of water. In the same way, this sector is in a dynamic that makes the actors involved as well as the interests of each one varied. This situation creates dysfunctions in the water supply chain. We started from a community strategy where the communities had control over the revenues they managed without taking into account the tax rules in force, to a delegated management where the community associations went from managers to simple associations of water consumers with the mission of monitoring the contracts between the town hall and the farmer. It is imperative to review management strategies by involving all stakeholders in the decision-making and management process as advocated by the second principle of IWRM.

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