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Drinking Water Supply to the Communes of the Couffo Department: Analysis of the Implementation of Programming

Hortensia ACACHA

Department of Planning and development ENEAM, Cotonou, Benin

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Abstract

To understand deeply the factors that explain the non-compliance with communal drinking water supply plans in the Couffo department in this paper, first we have just determined the level of drinking water service that each structure LFB and WHF9 provides to the population. Then the levels of access to drinking water in the localities were also determined. Finally, a diagnosis was made of the system set up in the Couffo department to monitor the implementation of municipal programming. This paper concludes that the actual construction of the works is also independent of the low access to drinking water services in the beneficiary localities at the 5% threshold. However, there is a 43.5% chance that the actual completion of the works depends on poor access to drinking water in the localities. In addition, it appears that the absence of an effective system for monitoring-evaluation of the implementation of communal planning not only favours the execution of unscheduled works but also the non-compliance with the order of priorities in localities to be equipped with WHF.

Keywords: Water, Planing, Hydaulic infrastructure, Supply

1. Introduction

The decentralization that took place in Benin with the establishment of the first communal councils at the beginning of 2003 gave the municipalities important responsibilities in promoting grassroots development. In this context, the municipality is now responsible for drawing up its Municipal Development Plan (PDC), which it implements in harmony with national guidelines, in order to ensure the best living conditions for the entire population.

In the drinking water supply sector, the municipal contracting authority is affirmed by law 97-029 of 15 January 1999, which stipulates that “the Commune is responsible for the construction of hydraulic infrastructures as well as the supply and distribution of drinking water to the populations”.

Due to this new legal context, Benin's commitment to the Millennium Development Goals (MDGs), the need to face poverty and the implementation of the Government's Program of Action, the review of the 1992 National Water Supply Strategy was necessary. This review resulted in the AEP strategy for the period 2005-2015, which was adopted in March 2005 by the Government of Benin. One of the basic principles of this new strategy is the decentralization of the decision-making process through the Municipalities, which plan, based on the drinking water needs of the populations, to carry out the works according to a spatial planning approach.

This principle has therefore put an end to the demand-side approach in favour of the programmatic approach by the Municipalities of the works to be carried out on their territory in order to correct persistent disparities in access to drinking water for low-income populations, especially in rural areas.

Indeed, the implementation of the demand approach (old approach) through the expression of needs by the populations has deprived access to drinking water to communities with low financing capacity with regard to the mandatory financial contributions to be mobilized and released to benefit from the construction of a structure. These poor communities were generally deprived of water points, since the decentralized water service only programmed requests for which at least 60% of the financial contribution to the initial investment was mobilized through an open account, generally with the Local Casing of Agricultural Credit (CLCAM). In practice, villages or localities with low financial capacity were ignored in the absence of a mechanism to cover their financial participation.

In view of the challenges of reducing disparities in access to drinking water on the one hand and the new legal context of the sector introduced by decentralization on the other, the programmatic approach was immediately imposed on the municipalities and became the only basis for programming and implementing works in decentralized territories. It is known as

the term “Communal Water Programming” and uses the locality as the planning unit. Drinking water needs must therefore be determined from the localities independently of their financing capacity and taking into account Benin's drinking water supply standards, namely a Manual Pump Drilling (MPD) for 250 inhabitants and a Borne Fontaine (BF) for 500 inhabitants. Communal Water Programming” is basically based on the coverage rate of each locality, which is the ratio between the population served and the population of the locality. It is aimed primarily at localities that are not, or less, equipped with a water point and travel a long distance to have access to water points.

However, a comparison of the achievements and forecasts for the period 2011-2014 of 24 municipalities in the departments of Atacora, Donga, Couffo, Ouémé and Plateau reveals that the stakeholders in the drinking water sector have not practically taken into account the physical planning made by the municipalities when carrying out the WHF. Indeed, between 43% and 84% of the WHF carried out are not included in the priorities and physical planning established by the municipalities for the period 2011-2013, with the Couffo department in the lead (GIZ, 2014).

In addition, the report of the workshop “Assessment of municipal project management in the water and sanitation sector” conducted by the Multi-Year Water and Sanitation Program

Phase 2 (PPEA-II) in November 2013, makes the same observation for all municipalities in Benin.

These elements confirm a major problem that today constitutes one of the bottlenecks in the planning of drinking water supply for populations. This concerns the failure to respect the physical planning of the municipalities during the construction of the works. In other words, works are carried out in unidentified priority and/or unscheduled locations. This circumvention of municipal programming has a twofold dimension, namely:

- failure to comply with the orders of priorities established by the municipalities in terms of localities to be equipped with water points;

- the execution of works in unscheduled localities, those already equipped with water points or very small localities.

The consequences of this situation are:

- the sustainability of disparities in access to drinking water;- the destabilization of communal councils: local elected officials accusing their executives of using public drinking water services to consolidate their political influence;- the increase in prejudices about the ability of municipalities to properly assume project ownership in the drinking water sector;- the gradual deterioration of relations between decentralized water services and municipalities.

The self-assessment of the municipal contracting authority carried out by PPEA-II in November 2013 attempted to provide elements of answers to the question without success; the services deconcentrated water authorities and municipalities blaming each other on the issue without providing a tangible explanation for the problem.

In addition, some actors in the sector point out without any study, the lack of coordination and leadership of the municipalities in the sector, the influence of policies on the final choice of localities to benefit from drinking water. This second explanation seems convincing since communal planning is developed in the presence of all local elected officials and adopted by the Communal Council.

In a current context of transfer of resources to municipalities, marked by a co-responsibility of municipalities and decentralized water services in the construction of structures, what are the factors explaining such a poor performance in the implementation of municipal planning?

It is this question that justifies the choice of the subject of this study entitled “Analysis of the implementation of communal programming in the Couffo department”. The answers provided to it will be able to provide input for the development of an appropriate strategy for the implementation of municipal drinking water supply programs in rural and semi-urban areas.

The general objective of this study is to analyze the factors that explain the circumvention of municipal planning during the construction of the works.

Specifically, it is a question of:

- determine the link between the level of access to drinking water services and the prioritization of localities to be equipped with WHF;

- Measure the influence of the level of access to drinking water services in localities on the effective implementation of WPM;

- Assess the monitoring-evaluation of the physical implementation of WHF in the Couffo

department.

Three hypotheses guide this study. They are formulated as follows:

- the communal prioritisation of WHF is independent of the level of access to drinking water services in the localities;

- the low level of access of localities to drinking water services determines the achievement of WSPs;

- the lack of monitoring and evaluation of the physical achievements of the WHF contributes to non-compliance with programming.

2. Methodological Approach

Data on water points and localities come from several sources.

- the data on water points come from the databases of water point inventories and localities carried out by the GIZ from 2009 to 2011. These inventories were carried out in the field and validated by the municipalities and decentralized water services. Requests were made to obtain the data necessary for the analyses.

- the data of the programmed localities and those that have benefited from an unscheduled work, are taken from the municipal drinking water supply planning reports of the communes;

- the data on localities are taken from the databases of water point and locality inventories carried out by the GIZ (international organization of Germany) from 2009 to 2011. The localities selected are those of rural and semi-urban areas.

Data processing was carried out using two methods:

- descriptive analysis for the calculation of parameters such as averages, proportions. They were obtained with the SPSS17 software.

- spatial interpolation to determine the level of access to drinking water in localities. The Voronoi diagram method was chosen after applying all the possibilities offered by Vertical Mapper 3.1. It is this method that has presented reliable results given the data used. The reliability of the results was verified by comparing those obtained by applying the method with those obtained directly for localities with water points

To better achieve the objectives set out in this study, the construction of hypothesis verification strategies is necessary to identify and justify the choice of variables and indicators related to the specific objectives described above and the related collection method.

To verify hypothesis1 “The communal prioritization of WHF is not linked to access to drinking water services in localities”, it will first be determined the level of access to drinking water services in localities for two reasons:

- the system access method is an incomplete method for characterizing access to drinking water as indicated by the work of Pezon (2012) presented in the literature review;

- the system access method is used when planning the drinking water supply.

In a second step, a cartographic analysis will determine the level of access to drinking water services in all localities.

The level of service to drinking water in localities is linked to the levels of service provided by water points. These service levels are determined as follows:

Level of service of the WHF

It is obtained from three variables which are:

- the water point functionality index: {Breakdown=0.6 ; Malfunction=0.8 ; Normal operation =1};

- the water availability index: {Tari during the day=0.6 ; Tari dry season=0.8 ; Perennial=1} ;

- the water quality index: {Bad=0.6 ; Trouble=0.8 ; Good=1} ;

The level of service of the WHF is the value of the lowest index of the scores of the three indices: {Low=0.6 ; Medium=0.8 ; High=1}.

Level of service of LFOs and PEAs

For BFs and PEAs, their level of service is obtained from three indices as well:

- the water availability index: {Insufficient during the day=0.6 ; insufficient throughout the dry season=0.8 ; Adequate=1} ;

- the water quality index: {Bad=0.6 ; Trouble=0.8 ; Good=1} ;

- the functionality index of the BF: {0 Valve=0.6 ; 1 Valve=0.8 ; 2 Valves=1}.

The level of service of a LFO is the lowest of the three index scores: {Low=0.6; Medium=0.8; Strong=1}.

The indicator of access to drinking water services is modulated by the health status of the localities, since certain exceptional situations such as the appearance of epidemics linked to water quality (cholera) or the pollution of a water source may also lead the municipality to review its programming.

Thus, if a locality was in such a sanitary situation at the time of the construction of a structure, its level of access to the drinking water service is equal to 0.6.

The parameter “water quantity” is not considered in this study because according to the report on the study on the situation of the exhaustive leasing of AEVs in Benin, published in 2014 by Director of Water, the unit consumption per capita is 6.34 litres and explains the low density around water points.

In addition, a cartographic analysis carried out by us as part of this study on the distance between water points and localities shows that on average water points are located 288 m as the crow flies from their locality of origin. This justifies the fact that the “distance” parameter did not take into account in our analysis; the national standard being 500 m.

functioning normally.

Hypothesis testing

Let:

- P the population of localities whose technical solution is the realization of a WHF. These are localities that cannot be served by a village water supply network or by the SONEB (National Society of water) network and have a minimum population of 100 inhabitants.

- X the variable “prioritized locality” having two modalities: {Yes, No};

- Y the variable “access to drinking water service” having three modalities: {High access, Medium access, Low access}.

The hypothesis tested is as follows:

- H0 : The prioritization of localities to be equipped with WHF is independent of their access to drinking water services;

- H1: The prioritization of localities to be equipped with WHF depends on their poor access to drinking water services.

The decision rule is as follows:

- If χ2calculé <χ2Tabulé, α=5%,2ddl then the null hypothesis of the test is accepted and therefore the H1 hypothesis of our study is confirmed;

- If χ2calculé >χ2Tabulé, α=5%,2ddl then the null hypothesis of the test is rejected.

Where: χ2calculé is the calculated statistical value, α=5% the risk of error and χ2Tabulé, α=5%,1ddl the statistical value read from the Chi2 table.

To verify the hypothesis that "The low level of access of localities to drinking water services determines the achievement of WSPs", the following hypotheses are tested:

Let:

- P: the population of the localities;

- X the variable "Beneficiary of WHF achieved" having two modalities: {Yes, No}

- Y: the variable "Poor access to water services" having two modalities: {Yes, No}; the hypothesis tested is as follows:

- H0: The construction of the works is independent of the poor access to the drinking water service of the beneficiary localities;

H1: The effective completion of the works depends on poor access to drinking water services in the beneficiary localities

The decision rule is as follows:

- If χ2calculé <χ2Tabulé, α=5%, 2ddl then the null hypothesis is accepted

- If χ2calculé >χ2Tabulé, α=5%, 2ddl then the null hypothesis is rejected.

Where: χ2calculé is the calculated statistical value, α=5% the risk of error and χ2Tabulé, α=5%,1ddl the statistical value read from the Chi2 table.

Hypothesis 2 of our study will be accepted if the null hypothesis is rejected.

Several criteria can be considered to say that the monitoring-evaluation of a plan, programme, project, etc. is carried out. In this work, hypothesis3 will be accepted if the diagnostic analysis of the monitoring and evaluation system for the implementation of municipal programming leads to one of the following conclusions:

- CAMC or the CC does not meet regularly to monitor the implementation of

"Communal Water Programming";

- There are no indicators available for monitoring the implementation of the

"municipal water programs";

- There are no communal (internal) monitoring reports Ŕevaluation on communal programming.

3. Results

3.1 Level of Access to Drinking Water Services in Localities and Prioritization of WMF

Data from the inventories of localities and water points carried out in 2011 in the Couffo department show that the municipal works park, the subject of this study, has 918 works in operation. This fleet consists of 475 FPM and 443 BF. The table below shows the distribution of the works by municipality.

Table 1. Distribution of water point types by commune

			Municipality				
			APLAHOUE	DJAKOTOMEY	DOGBO	KLOUEKANME	Total
Type_ofwater infrastructure	BF	Number of employees	131	95	128	121	475
		% compiled in Municipality	44.4%	54.3%	48.9%	65.1%	51.7%
	FPM	Number of employees	164	80	134	65	443
		% compiled in Municipality	55.6%	45.7%	51.1%	34.9%	48.3%
Total		Number of employees	295	175	262	186	918
		% included in Municipality	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Survey results, 2013.

The distribution of these facilities by level of service is presented in the following table:

The distribution of water point types according to drinking water service levels is shown in the following table:

Table 2. Number of water points by level of service

	Number of employees	Percentage	Valid Percentage	Cumulative Percentage
Valid Low	222	24.2	24.2	24.2
Strong	489	53.3	53.3	77.5
Medium	207	22.5	22.5	100.0
Total	**918**	**100.0**	**100.0**	

Source: Survey results, 2013.

This table shows that:

- 24% of drinking water points provide a poor service;

-53% of drinking water points a strong service;

- 23% of drinking water points offer an average service.

The distribution of water point types according to drinking water service levels is shown in the following table:

Table 3. Distribution of water point types by level of drinking water service

			Service_Level			
			Low access	Strong access	Average access	Total
Type_Work BF	Type_Work BF	Number of employees	98	187	190	475
		% included in Type_of water infrastructure	20.6%	39.4%	40.0%	100.0%
	FPM	Number of employees	124	302	17	443
		% included in Type_of water infrastructure	28.0%	68.2%	3.8%	100.0%
Total		Number of employees	222	489	207	918
		% included in Type_of water infrastructure	24.2%	53.3%	22.5%	100.0%
Population		Number of employees % included in Type_of water infrastructure	86 132 14.4%	219 225 36.5	294 873 49.1%	600 229 100.0%

Source: Survey results, 2013.

This table shows that 68% of WMFs provide good drinking water service while only 39% of WMFs provide the same service to the population.

In terms of populations, it should be noted that:

- 14.4% of the population of the municipalities studied have low access to drinking water services;
- 36.5% of the population of the municipalities studied have average access to drinking water services;
- 49.1% of the population of the municipalities studied have strong access to drinking water services.

The spatial interpolation of water service levels of water points by the simple Voronoi diagram method with smoothing without exceeding 918 structures gives the access map for drinking water service represented by Figure 1 below.

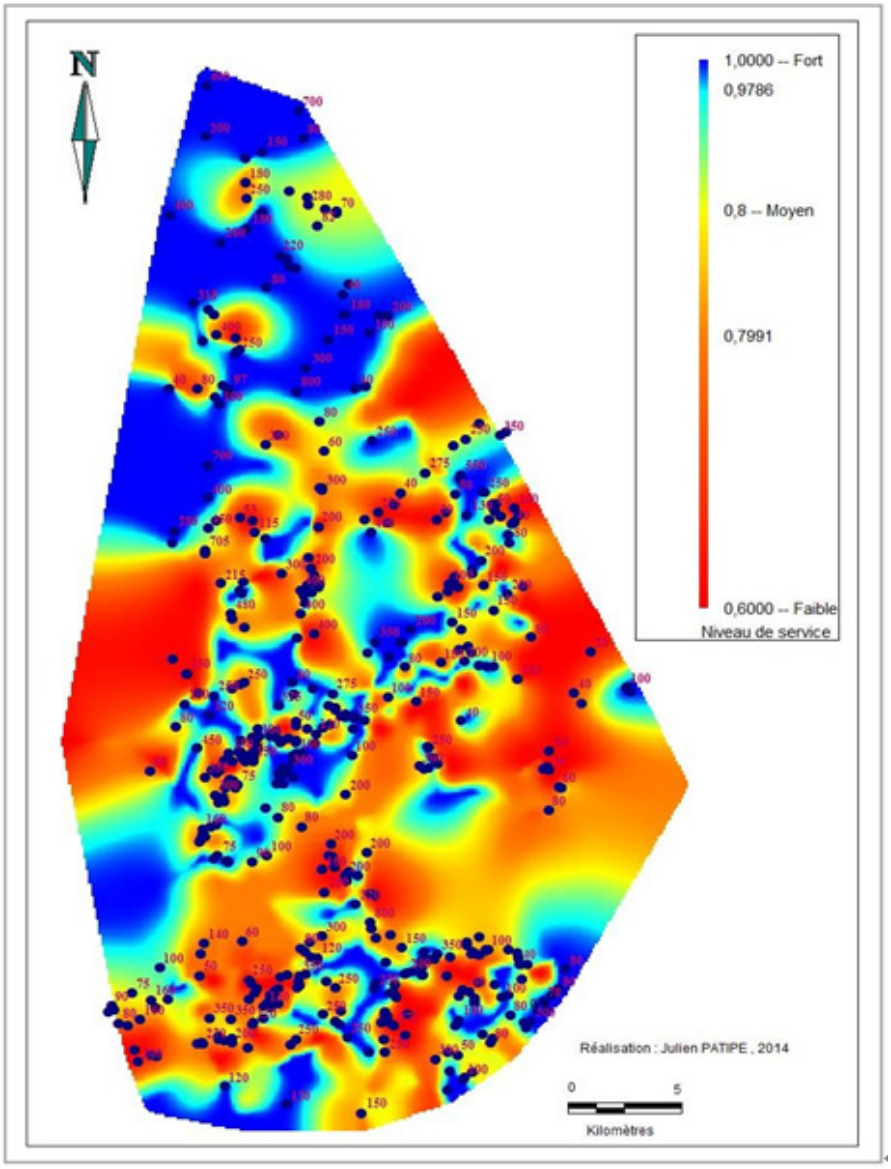


Figure 1. Map of access to drinking water services

The cartographic analysis carried out using MapInfo 8.0 and Vertical Mapper 3.1 software made it possible to determine the level of access to drinking water in the localities. The result of this analysis is presented in the following table:

Table 4. Level of access to drinking water services and prioritization of localities

			Service_Level			
			Low access	Strong access	Average access	Total
Prioritised	NO	Number of employees	65	116	63	244
		% included in Priority	26.6%	47.5%	25.8%	100.0%
	YES	Number of employees	32	37	32	101
		% included in Priority	31.7%	36.6%	31.7%	100.0%
Total		Number of employees	97	153	95	345
		% included in Priority	28.1%	44.3%	27.5%	100.0%

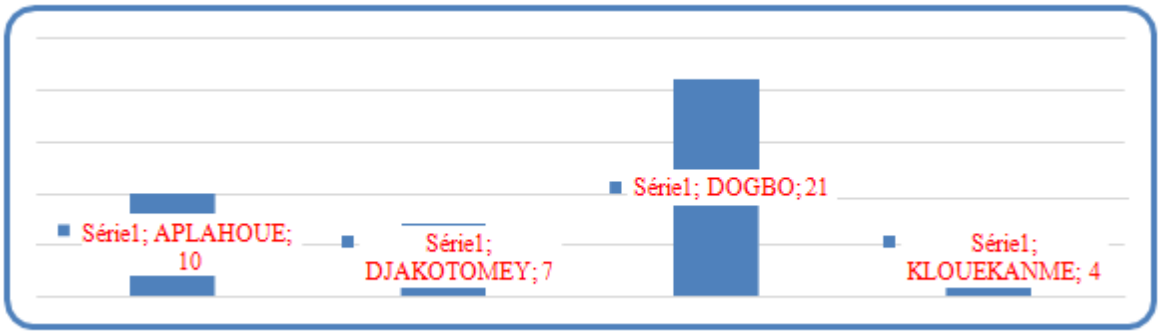
Source: Survey results, 2013. This table shows that approximately:

- 32% of priority localities have low access to drinking water services;
- 32% of priority localities have average access to drinking water services;
- And 36% of the prioritized localities have good access to drinking water services.

These proportions indicate that 68% of the prioritized localities have at least average access to drinking water services.

3.2 Level of Access to Drinking Water Services in Localities and Effective Implementation of WSPs

According to the reports of the "Drinking Water Supply Programming 2014-2016", 42 community WMFs were carried out in the communes of Aplahoué, Dogbo, Djakotomey and Klouékanmè. The distribution of the FPM achieved by municipality is presented in the figure below:



Source: Survey results, 2013

It appears that the municipality of Dogbo benefited over the period 2011-2013 from 50% of the WHF carried out in the four municipalities.

As shown in the table below, 38% of WPMs were carried out in localities with no low access to drinking water services.

Table 5. Poor access to drinking water services and effective implementation of WPM

			Low_Access		Total
			NO	YES	
Beneficiary_FPM	NO	Number of employees	756	1477	2233
		% included in Beneficiary_FPM	33.9%	66.1%	100.0%
	YES	Number of employees	16	26	42
		% included in recipients_FPM	38.1%	61.9%	100.0%
Total		Number of employees	772	1503	2275
		% included in recipients_FPM	33.9%	66.1%	100.0%

Source: Survey results, 2013.

3.3 Assessment of the Monitoring and Evaluation of the Implementation of the Physical Programming of the WHF

The results relating to objective 3 are based on the responses of the semi-structured interviews held with stakeholders in the drinking water sector in the municipalities concerned by this study. These results are summarized and analyzed under five headings: the composition of the CCEA, commission of governace of water; the functioning of the CCEA, the decisions of the Municipal Councils, the collaboration between the S-Eau and the Municipalities and the indicators for monitoring the implementation of municipal programming.

3.3.1 CCEA Membership

The composition of the CCEAs as it appears in the creation decrees can ensure proper monitoring of the implementation of municipal programming. Indeed, the presence of permanent members (local communities; important people Mayor and Deputies) within this territorial governance body guarantees the continuity of monitoring and the development of an institutional memory. In addition, this framework provides for the participation of the department's decentralized water service. The purpose of this participation is to encourage, according to the municipal actors, the sharing of information on the work carried out by this service; the transfer of resources to the municipalities, which is still in an embryonic phase. In addition, the decrees creating the CCEAs provide for the participation of civil society to ensure citizen monitoring of the implementation of municipal programming.

3.3.2 CCEA Operations

The results of the survey indicate that CCEA have not held any meetings since their inception. The main reason given (94% of respondents) is that the municipalities do not have the financial resources to support the participants. In addition, 6% of the respondents believe that the actors who control the execution of the works are the Mayors and the Society of Water, and that they have no interest in having the members of this framework meet. This allows them to implement communal programming as they see fit.

The lack of ownership of the CCEA by the executive and communal services and the lack of advisory assistance from the S-Water also explain the lack of functioning of this framework.

3.3.3 Decision of the Municipal Councils

It emerged from the interviews that the Communal Councils address during their meetings, the question of bypassing communal planning but without deliberations. According to the borough chiefs (89%) and reading the decisions of the Municipal Councils, no solution has been adopted to curb the phenomenon. Moreover, the standing committee in charge of municipal social affairs does not really look into the subject.

3.3.4 Collaboration between the Municipalities and Society of Water

The result obtained confirms that of the workshop on the assessment of municipal project management in the water and sanitation sector organized by program PPEA-II in November 2013. The municipalities accuse the Society of water and the Decentralization service of water DMEE of obstructing the exercise of municipal contracting. At the same time, Society of water considers that localities benefiting from FPM are sent by the municipalities and that the latter are not often available to participate in site meetings. In addition, the municipalities are raising the behavior of design offices and drilling companies under the control of the Society of water which do not announce themselves before their intervention and would therefore prevent the municipalities from checking whether the localities where drilling is carried out are those actually planned.

The collaboration between Society of water and the municipalities is based on an opacity maintained by both parties to bypass programming as much as possible. This statement is felt by 73% of communal respondents in general and 92% of district heads.

Moreover, the absence of a departmental arbitration of the sectorial program budget according to 55% of the municipal technicians does not allow the municipality to know how many works will actually be carried out on its territory. These technicians claim that knowing the number of projects from which each municipality benefits would help the municipality to reduce the number of projects carried out outside the municipal programming.

Finally, 93% of respondents at the Society of Water level noted that relations between the decentralized service and the municipalities are made difficult by the fact that some localities to be equipped with boreholes are retained by the central level (Direction of Water, Ministry of Water) to the detriment of municipal planning.

3.3.5 Indicators

There are no indicators to monitor the implementation of municipal programming at either the municipal or Society of Water level. It has also been found that municipalities and water authorities do not have tools and methods for monitoring the implementation of municipal

planning in the drinking water sector.

It is the various technical advisors of the PEP-GIZ international institution of Germany who develop tools and methods for monitoring communal programming. But their field of action remains limited since they are in support and advice to the decentralized water service.

4. Conclusion

The general objective of this study is to answer the question “what are the factors that explain the non-compliance with communal drinking water supply plans in the Couffo department”.

To answer this question, it was first determined the level of drinking water service that each structure provides to the population. Then the levels of access to drinking water in the localities were also determined. Finally, a diagnosis was made of the system set up in the Couffo department to monitor the implementation of municipal programming.

According to the analyses, hypotheses 1 and 3 were confirmed in contrast to the hypothesis

It is also observed that 47% of the water points in the Couffo department, on the basis of the criteria used, do not offer a high level of access to drinking water services to the population. In addition, the study concludes that the actual construction of the works is also independent of the low access to drinking water services in the beneficiary localities at the 5% threshold. However, there is a 43.5% chance that the actual completion of the works depends on poor access to drinking water in the localities. This suggests that stakeholders are to some extent targeting communities with difficult access to safe drinking water.

In addition, it appears that the absence of an effective system for monitoring-evaluation of the implementation of communal planning not only favours the execution of unscheduled works but also the non-compliance with the order of priorities in localities to be equipped with WHF. The CCEA set up to monitor the conformity of the works' achievements with the programming does not work in any of the municipalities, mainly because of a lack of financial resources and appropriation by the municipalities and the CCEA's Society of water . There are no monitoring and evaluation manuals for the implementation of communal program containing tools, methods and indicators for monitoring the implementation of drinking water works.

References

Curtis, V., Cousens, S., Kanki, B., Mertens, T., Traore, E., Diallo, I., & Tall, F. (1995). Potties pits and pipes, explaining hygiene behaviour in Burkina Faso. *Social Science and Medicine, 41*(3), 383-393. https://doi.org/10.1016/0277-9536(94)00341-P

DG-Water. (2010). Programming guide of water procurement in rural area and semi rural area, Benin.

DG-Water (2010). Technicalstudies, delivery and work in the water sector de l'eau potable, Using guide od communes, Bénin.

DIBI, A. (2008). Planning and management of drinking water supply by collective terminals in Ouagadougou: Design and implementation of a GIS tool to support decision-making, Burkina Faso.

Dos Santos, S. (2007). Iniquities in access to water and socio-sanitary issues in Ouagadougou, Burkina Faso. In M. Amadou Sani, P. Klissou, R. Marcoux, & D. Tabutin (Eds.), Villes du

Sud, dynamiques, diversités et enjeux démographiques et sociaux, Editions des archives contemporaines, Paris.

GIZ. (2014). Programming of the drinking water supply of the municipality of Dogbo Period 2014-2016.

GIZ. (2014). Programming of the drinking water supply of the municipality of Aplahoué Period 2014-2016.

GIZ. (2014). Programming of the drinking water supply of the municipality of Lalo Period 2014-2016.

GIZ. (2014). Programming of the drinking water supply of the commune of Klouékanmè Period 2014-2016.

GIZ. (2014). Programming of the drinking water supply of the municipality of Djakotomey Period 2014-2016.

Hugon. (2007). Towards a new form of water governance in Africa and Latin America. In B. Mikaïl (Ed.), L "or bleu, nouvel enjeu géopolitique, Revue internationale et stratégique, Dalloz.

MAHRA (2007). Programme National de l'Approvisionnement en Eau Potable et Assainissement à l "horizon 2015, Manuel de suivi-évaluation Tome1: cadre conceptuel, Burkina Faso.

MAHRA (2008). Programme National de l'Approvisionnement en Eau Potable et Assainissement à l "horizon 2015, Manuel de suivi-évaluation Tome2: Outils et méthodes, Burkina Faso.

Naulet, J., Oudot, S., & Janique, E. (2011). Decentralization and drinking water and sanitation services: what strategies to strengthen municipalities for access to services, Gret, coll. debates and controversies n° 7.

United Nations. (1993). United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, United Nations, New York.

United Nations. (1997). General Assessment of the World's Freshwater Resources: Report of the Secretary-General of the United Nations, E/CN.1997/9, Commission on Sustainable Development, 5th session.

PPEA II. (2013). Report on the self-assessment of the municipal contracting authority, Benin.

Quivy, R., & Van Campenhoudt, L. (1995). Manuel de recherche en sciences sociales, Paris, Dunod.

Satterthwaite, D. (1995). Les quatre "révolutions environnementales" des villes, Le Courrier Afrique Caraïbes et Pacifiques- *Union Européenne, 149*, 60-63

WASHCost. (2012). From Access to Drinking Water Systems to Access to Services: Methods and Tools, Working Paper 4. http://www.washcost.info/page/1983

White, G. F., Bradley, D. J., & White, A. U. (1972). Drawers of Water, Chicago, Chicago University Press.

WEBSITES VISITED

http://www.wikipédia.Mht.

http://hivcode.org/french-code-/le-code-de-bonnes-pratiques-pour-les-ong-ripostant-au- hiv/.
http://docs.qgis.org/2.2/fr/docs/gentle_gis_introduction/spatial_analysis_interpolation.html