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National Consultancy To Enhance The Elaboration Of Water-Related SDG Indicators

Evaluation Report on the Information System of the Water Sector in Paraguay

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Table of contents

1. Introduction

Paraguay has committed to comply with the 2030 Agenda, as a guide for the country's policymaking to raise the quality of life of the population. Paraguay also has its own 2030 Paraguay National Development Plan (NDP), fully aligned with the 2030 Agenda.

Water and sanitation are part of the commitments contemplated in both documents, and the sector faces important challenges to comply with the 2030 Agenda and the NDP, as detailed in the [2018 National Development Plan for the Water and Sanitation Sector](#).

One of these challenges is the generation of relevant and comprehensive information on the sector. Without this information, it is impossible to strengthen sectoral planning and formulate inclusive, timely, and sustainable public policies that reflect the production, in real-time, of increasingly disaggregated data associated with the reality of the territories.

The consultancy took into account the need for a structured information system for national evaluations of the water sector, describing the current status of the sector and determining the essential requirements to establish a centralized, articulated and sustainable information system.

It is important to underscore that, as of late 2019, the General Directorate of Statistics, Surveys & Censuses (DGEEC) is a member of the Data for Now initiative that, together with partners and experts, seeks to support National Statistics Offices to consolidate their access to timely data. The initiative is led by the Global Partnership for Sustainable Development Data (GPSDD), the World Bank, the United Nations Statistics Division, and SDSN TReNDS.

Another initiative to consolidate a sectoral information system is the creation of the Interagency Coordination Committee of the Water & Sanitation Sector (CICOSAPS, for its Spanish acronym), through Decree 874, dated December 10, 2013, which stipulates:

"Given the characteristics and impact of investments in the drinking water and sanitation sector as one of the main factors of public health, quality of the environment and improvement of the quality of life of the population, it is imperative to unite and coordinate the activities of all the institutions involved in the sector [Own translation]."

"The goal of the Interagency Coordination Committee of the Drinking Water & Sanitation Sector is to coordinate and harmonize the actions of the public and private entities and cooperation agencies involved in the drinking water and sanitation sector across the national territory [Own translation]".

The CICOSAPS includes the following institutions:

1. Ministry of Public Works & Communications (MOPC, for its Spanish acronym)

2. Ministry of Finance (MH, for its Spanish acronym)

3. Ministry of Public Health & Social Welfare (MSPBS, for its Spanish acronym)

4. Technical Planning Secretariat (STP, for its Spanish acronym)

5. Ministry of the Environment & Sustainable Development (MADES, for its Spanish acronym)

6. Water Services Regulator (ERSSAN, for its Spanish acronym)

7. Water Services Company of Paraguay (ESSAP, for its Spanish acronym)

8. Ministry of Urban Planning, Housing & Habitat (MUVH, for its Spanish acronym)

9. Ministry of Education & Sciences (MEC, for its Spanish acronym)

10. National Emergency Secretariat (SEN, for its Spanish acronym)

11. Paraguay's Directorate of Itaipú Binacional Hydroelectric Plant

12. Paraguay's Directorate of the Yacyretá Binacional Hydroelectric Plant

13. National Institute of Rural & Land Development (INDERT, for its Spanish acronym)

14. Paraguayan Institute of Indigenous Affairs (INDI, for its Spanish acronym)

These were the institutions consulted. Also, research was made using secondary information sources.

2. General objective of the consultancy

Evaluate the information on the current status of the water information system, based on diagnosis on data generated by different sources, to develop a data and indicators based water system, including water indicators related to the Sustainable Development Goals (SDGs), to expand and improve the information in order to follow-up on national and international plans.

3. Specific objectives

a. Review the information available and the status of the information system of the water sector to generate situational data maps.

b. Collect information on institutional needs to strengthen and achieve the sustainability of the indicators available and those being developed.

c. Establish guidelines to develop indicators that respond to national and international

commitments, with an emphasis on SDG indicators and the monitoring of the NDP 2030.

d. Determine the possibility of developing new water-related indicators based on the use and exploration of traditional and non-traditional data sources.

e. Define the alignment of the water indicators related to the SDGs and the response capacity to measure them.

4. Information available at the institutions of the CICOSAPS

To collect relevant information of the sector available in the institutions of the CICOSAPS, we held virtual meetings and preliminary discussions with representatives of the Centro de Pensamiento Estratégico Internacional (Cepei) and the General Directorate of Statistics, Surveys & Censuses (DGEEC), the counterparts and supervisors of this consultancy. Based on these virtual meetings, the first working visit was made to the Drinking Water & Sanitation Directorate (DAPSAN) of the Ministry of Public Works & Communications (MOPC) which, as the CICOSAPS coordinator, organized the contact with the representatives appointed by the institutions.

The current health quarantine limited our mobility and visits to the institutions. Consequently, the interviews were conducted through phone calls and virtual meetings. The fourteen institutions that make up the CICOSAPS were contacted, and twelve of these institutions responded within the time frame established for the present consultancy.[1]

As data available was collected, it was confirmed that most of the institutions do not assign sufficient resources to generate reliable data and statistics. Instead, they produce fragmented and unsystematic information through their different administrative records that they use as input for their work plans. Except for the institutions which mission is to generate and disseminate information, such as the DGEEC.

Information Systems

Regarding the characteristics of the information systems available, the following is presented per institution:

1. Ministry of Public Infrastructure & Communications (MOPC, for its acronym in Spanish):

The entity that assists the Head of Service of the Paraguayan State and exercises sectoral stewardship, through its technical body, the Drinking Water & Sanitation Directorate (DAPSAN, for its Spanish acronym). The MOPC is the institution that coordinates the Inter-institutional Coordination Committee for Drinking Water & Sanitation (CICOSAPS, for its Spanish acronym) and focuses on harmonizing criteria and efforts to set up a Sectorial Information System providing updated and national indicators to report on SDG 6.

In order to produce sectoral data, since 2016 Paraguay has participated in the regional initiative "Rural Water & Sanitation Information System" (SIASAR, for its Spanish acronym). This system has 4 information modules as follows:

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1. Please see Interviews section on page 20.

Module	Components
1. Drinking-Water and Sewerage System	• Type of service • Water points • Infrastructure • Treatment
2. Community	• Population • Location • Water and sanitation coverage • Hygiene practices
3. Service Provider	• Legal status • Performance • Income/Expenses • Operation and maintenance practices
4. Technical Assistance Provider	• Jurisdiction • Frequency of intervention • Resources

The SIASAR systematizes the information of these areas in a set of aggregated indexes at two levels:

On the first level, the SIASAR is made up of a set of 60 indicators, classified into 24 components, which are then grouped into 6 dimensions:

  i. Water Service Level (NSA)
  ii. Sanitation and Hygiene Service Level (NSH)
  iii. Schools and Health Centres (ECS)
  iv. Status of Water Infrastructure (EIA)
  v. Service Provision (PSE)
  vi. Provision of Technical Assistance (PAT)

On the second level, the above-listed dimensions are grouped into two partial indexes:

  i. Water, Sanitation, and Hygiene Service (WASH) Level
  ii. Water Services Sustainability Index (ISSA)

These two partial indexes make up a final overall aggregate index: the **Water & Sanitation Services Performance Index (IAS)**.

To support the SIASAR's implementation, on December 30, 2019, the Executive Branch enacted Decree 3189 "Creating the National Strategic Committee for the Implementation of the Rural Water and Sanitation Information System (SIASAR, for its Spanish acronym)."

This coordination body includes the Drinking Water & Sanitation Directorate (DAPSAN, for its Spanish acronym) of the Ministry of Public Works, the National Sanitation Service (SENASA, for its Spanish acronym), the Water Services Regulator (ERSSAN, for its Spanish acronym), the Ministry of Information & Communication Technologies (MITIC, for its Spanish acronym), the Technical Planning Secretariat (STP, for its Spanish acronym) and the General Directorate of Statistics, Surveys & Censuses (DGEEC, for its Spanish acronym).

At present, the SIASAR has collected information in 60 locations in the Central Chaco, 40 locations in the Mcal. Estigarribia District and 20 locations in the District of Filadelfia, through the two consultancies hired by the MOPC. As of the preliminary collection of

data, the MOPC has applied for World Bank funding to complete the initial survey of rural locations in the 255 municipalities of the country in a 2 years time period. Once this initial survey has been completed, the strategy is to periodically update it based on the work of the Water & Sanitation Units (UASs) that are part of each municipality, although, at present, only 25 UASs have been established.

DAPSAN also implemented the Basic Providers' Survey, covering a total of 68 providers in rural areas (18 in Ñeembucú, 7 in Misiones, 36 in Concepción and 7 in the Central Department), gathering data on the following variables:

i.   General Information on the Community
      Location of the community
      Relevant aspects of the community
ii. Information on the service provision system project
iii. System-specific information
      System overview
      Description of the financing system
      System's technical data
      Operation and maintenance data
      Data on service costs
      Organization of the providers
iv. Environmental Data
v.   Data on the operation of providers

2. Ministry of Finance (MoF, for its acronym in Spanish):

Regarding the public budget, the MoF has institutional budgets and information on budget execution. However, this information is not grouped at the level of interventions in the water and sanitation sector, whereby it is difficult to know the exact budgeted and executed amount on water. Also, ESSAP S.A., the binational companies, and the municipalities are not included in the public budget.

The Public Investment System, of which the MoF and the STP are part, has information on investment projects in two stages: i) The pre-investment stage:

feasibility studies that public institutions submit for approval and inclusion in the public budget; and ii) The project execution stage, information on the total cost of the works, the physical progress, and the financial execution updated daily.

3. Ministry of Public Health - National Environmental Sanitation Service (SENASA, for its Spanish acronym):

SENASA has scarce systematized information for statistical purposes. It keeps a record of the Water & Sanitation Community Boards or Commissions (Water and sanitation providers in rural areas and small towns) created under SENASA's sponsorship, but their data have not been updated regularly.

The institution also has a GIS system available on its website. It shows the location and some variables of the water systems in the national territory, as well as water and sanitation information collected from the Family Health Units located in the Western Region of the country. This information is available in Excel format.

4. Technical Planning Secretariat (STP):

This institution does not collect sectoral information frequently. However, from 2014 to 2018 it implemented the Programa Sembrando Oportunidades, which intervened in the water and sanitation sector of poor communities in the departments of San Pedro, Concepción, Canindeyú, Itapúa, Caazapá, Misiones, Ñeembucú, and Caaguazú. The data collected refers to the following variables for each community and system:

**i.   **Data on Community Organization
**ii. **Data on Administration
**iii. **Data on Operation, Maintenance, and Planning
**iv. **Environmental Sanitation
**v.   **Health Education

Once the program was completed in 2018, the collection of data on water and sanitation was discontinued.

5. Water Services Regulator (ERSSAN, for its Spanish acronym)

Regarding the conditions to provide drinking water and sanitation service, ERSSAN has more systematized information. As of its creation (2002), it has consolidated information on the country's water and sanitation service providers, although limited by the lack of the necessary resources to ensure that the vast universe of operators (approximately 4,600) was covered and to secure continuous updating.

As of 2016, ERSSAN manages the Single Information System (SIU, for its acronym in Spanish)[2] on the drinking water and sewerage sector, including information on the following:

a. General data providers
b. b. Drinking water supply system
   i. Technical information on the system
   ii. Commercial and administrative data
   iii. Technical construction report and graphic system diagram
   iv. Rates applied
   v. Production costs
c. Compliance with quality and service continuity parameters, collected from the Annual Supervision Plan

The SIU has information on 3,300 operators, whose data was collected thanks to the consultancies hired for the initial information collection, with the support of the World Bank (Sector Modernization Project, concluded in 2018). The information is updated with the annual technical verification reports made by the institution's officials. However, given the limited number of systems surveyed each year due to the institution's budgetary restrictions, it will be difficult to cover all the providers and update the data of those already surveyed in the first stage.

Also, ERSSAN has the information submitted by service providers in compliance with the information requirements contained in the Service Quality Regulations, either for permit holders (up to 2,000 connections) and for concession holders (more than 2,000 connections). These information requirements are thorough to regulate the quality and continuity of the service, the rates charged, invoicing, payment collection, and administrative management data. However, in practice, many operators (especially the vast majority of small-scale operators) do not regularly submit information from their systems, thereby generating a persistent information gap.

The first challenge to consolidate the SIU is to incorporate the missing systems, in addition to capturing the new systems generated each year. This updating will require innovative strategies and, for such purpose, ERSSAN representatives are designing strategies such as resorting to support departmental governments and municipalities to help update data, as well as encouraging self-reporting by service providers themselves, through mobile applications to facilitate remote data loading and avoid mobilization costs.

6. Ministry of the Environment & Sustainable Development (MADES, for its Spanish acronym):

MADES is the enforcement authority of the Law No. 3239/2007 "Of the Water Resources of Paraguay" and, therefore, regulates the sustainable and integral management of all waterways and the territories producing them." Within MADES, the General Directorate for the Protection & Conservation of Water Resources (DGPCRH) is responsible for the management of water resources.

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2. The SIU does not have information available publicly.

The main information systems managed by MADES:

a. Monitoring of water levels and flows of surface waters considered a priority: Lake Ypacaraí, Yhaguy River, Capiibary River, and Pirapó River.
b. Monitoring of the entire basin of the Tebicuary River.
c. Monitoring of the Patiño aquifer, which is subjected to high levels of extraction and contamination risks.
d. As of 2019, MADES has implemented the Environmental Information System (SIAM) to provide information on production projects or public services requiring the use of water resources, with a view to the issuance of the respective Environmental License.

It also has information generated by specific consultancies, financed by projects that have already concluded and, therefore, up-to-date information can´t be ensured, namely:

a. Status of Surface Waters of the Plata Basin (Paraguayan Territory), carried out in 2018.
b. Status of Water of the Tebicuary River basin, carried out in 2016.
c. Framework Program for Sustainable Management of Water Resources of the Plata Basin, providing information on the existing wetlands in the basin of the Paraná and Paraguay Rivers.

As regards to information systems on hydrological resources, it is important to mention the information system managed by the Direction of Meteorology & Hydrology (DMC, for its Spanish acronym) of the National Bureau of Civil Airports (DINAC, for its Spanish acronym). DMH website presents relevant consolidated information on various institutions, given that this Directorate collects and posts a gamut of real-time data, through *inter-institutional agreements*, on variables relating to the availability and use of water resources, such as:

i. Rainfall levels in the country's different departments
ii. Levels of the Paraná and Paraguay rivers, and in the country's main ports
iii. Water demand for agricultural purposes by the country departments, for the Eastern Region
iv. Patiño aquifer well levels, conductivity, and temperature

This information is generated by its hydrological stations and remote readings of the stations of other institutions, such as MADES, Ministry of Agriculture & Livestock (MAG, for its Spanish acronym), National Administration of Navigation & Ports (ANNP, for its Spanish acronym), Itaipú hydroelectric plant and the Paraguayan Navy.

The DMH can be considered as a good practice in terms of its institutional arrangements to facilitate the future construction of a unified information system for the sector. The DMH publishes meteorological and hydrological information from several institutions on its website, based on common criteria and permanent updates to provide timely information to users in the public and private sectors.

7. Itaipú Binacional:
The Itaipú hydroelectric plant, the Brazil-Paraguay binational entity, has an International Hydro-Informatics Center (CIH), whose core business is to apply water-related information and communication technology tools. The CIH implements the "Yrato" project, a "Hydrological Monitoring and Early Warning System against Floods in Paraguay", and it provides information on the following variables of the main rivers in the country:

- Level and variation
- Precipitation
- Conductivity
- pH Level
- Temperature

- Turbidity
- Dissolved Oxygen
- Early Warning

8. Water service company (ESSAP, for its Spanish acronym)

ESSAP has three systems that operate separately, which are:

- **Commercial System:** It has been operating for more than 25 years and it processes the commercial information, using the COBOL programming language. It is composed of indexed records that hinder quick setup and effective information. Due to its long operational life, the configuration of the fields that house the variables has been adapted through modifications.

- **Land Registry System:** The land registry system is based on ArcGIS and captures information on the geo-location of connections with their various characteristics, the performance area, extension of drinking water and sewerage networks, etc. One of the difficulties mentioned, refers to the lack of precise information on the urban settlements in the service areas, as well as the lack of reliable statistical data on communities from DGEEC, to fully identify the amount of population benefited by the ESSAP.

- **SCADA system:** The system captures information produced by ESSAP and works independently of the Development area, the interaction being only for server maintenance.

ESSAP'S information systems are not interoperable and the information exchange is not automatic.

Annex 1 summarizes the main variables and indicators produced by the main institutions linked to the water sector.

5. Water indicators sustainability status overtime

When analyzing, in a general way, the 11 indicators to report on SDG 6 and the sources used to report Paraguay's situation, the difficulties caused by the lack of comprehensive and continuously updated information at the national level are highlighted. When considering existing regulations and the institutional framework, it is useful to promote a comprehensive view of

the sector to analyze the sustainability of the indicators available, and those that need to be developed to adequately report on the level of compliance with SDG 6.

Based on the survey, the following is a summary of the strengths and weaknesses of the main systems currently in operation:

| Institution/System	Strengths	Weaknesses
DGEEC • Permanent Household Survey (EPHC) • Multiple Indicator Cluster Surveys (MICs)	• Permanent update national coverage • Relevant information on water and sanitation quality at the household level	• Difficulty in adding multiple variables (EPHC) • It is not regularly updated (MICs) • Costs to perform frequent updates can be high (MICs)
ERSSAN • Unified Information System (SIU)	• It contains information on 3,300 operators • Partial annual update with on-site visits	• Does not include on-site sanitation or community data • It does not include all providers • Upgrading represents high costs
MADES • Environmental Information System (SIAM) • Water resources monitoring system	• Includes all water uses • Low cost of data capture: charge applicant • Immediate updating by hydrological stations • Critical basins and priority aquifers are covered	• Only from 2020 onwards did the information began to be uploaded online • Only the historical information corresponding to 2010-2014 has been uploaded • Given the costs, only the Tebicuary basin and the Patiño aquifer are monitored • It does not monitor groundwater resources at the country level

MOPC • Rural Water and Sanitation Information System (SIASAR)	• It contains complete information • It elaborates its own quality service indexes • It reflects in a very complete way the situation of the services in the rural areas	• The initial charge and update represent high costs given a large number of variables • The information is only available for rural areas
Ministerio de Hacienda • Public Investment System (SNIP)	• Pre-investment level projects with a level of detail • Updated physical and financial progress monitoring	• The information is only available for the central administration • It does not include important institutions such as ESSAP, Itaipú, Yacyretá, and municipalities

Source: own elaboration, 2020

Regarding water resource management and conservation, MADES is the enforcement authority, while DAPSAN, the technical body of the MOPC, is responsible for the stewardship of the drinking water and sanitation service. To report on the indicators, the information needs to be generated by two different, but highly interdependent, subsystems: The water and sanitation services subsystem and the water resources management subsystem, responsible for the availability and uses, among which an important flow of information will be generated, as depicted in the following graphic:

Graphic 1. Information flow on water resource management
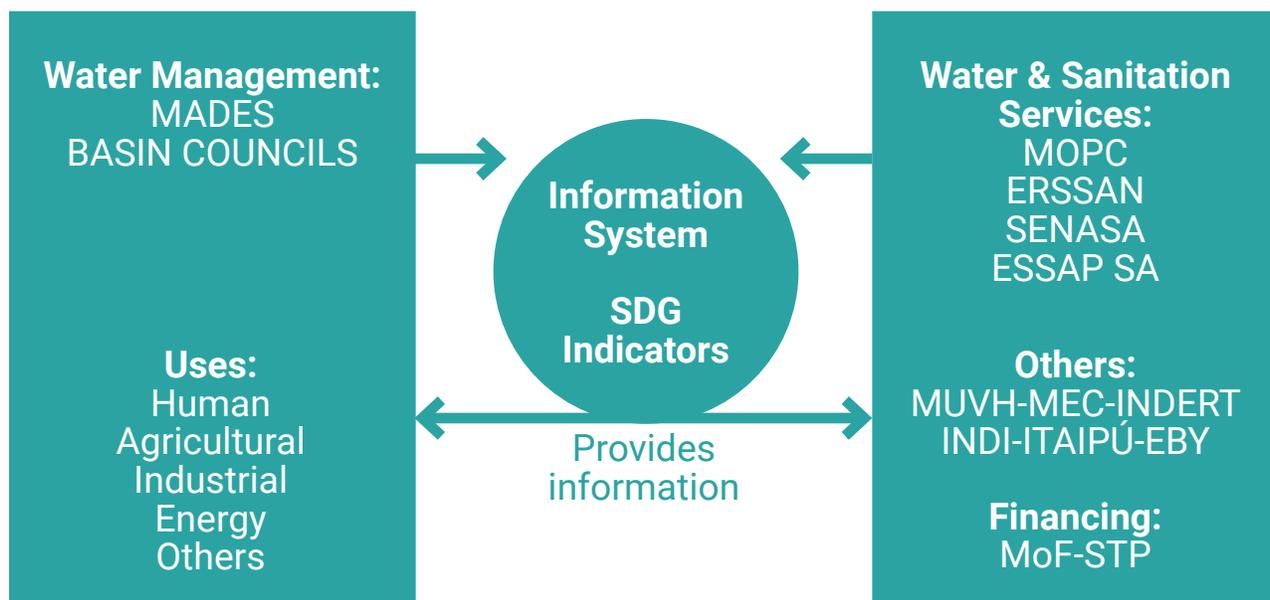
Source: own elaboration, 2020

When analyzing water and sanitation services, there is an intervention of several institutions with different mandates, therefore, it is necessary to coordinate investments and the criteria they apply. The main body is the CICOSAPS, its mission, and its institutions coordinate the interventions aimed at expanding the coverage of drinking water and sanitation services, improving the access to services, as well as the sustainability of benefits.

It is important to determine the information supply and demand from each of the Committee's institutions so that they can all contribute, access the information they collect and use it to plan their interventions. This information should be reported in a shared database and with only one source for queries and access, under harmonized criteria, as developed by the Meteorology & Hydrology Directorate, which posts information from various institutions on its web portal.

The nature of the Committee's members is diverse, hence, to facilitate their interaction it is necessary:

- To create a permanent mechanism to record, process and update data and information on the sector, as well as on the drinking water and sewerage services of the country
- To define appropriate, user-friendly, and feasible indicators to measure the effectiveness of sectoral policies, plans, and programs

Sustainable Development Goal 6

When considering the information required to report on the indicators related to SGD 6, a large part of them relate to water resource management and information on its uses. The MADES faces major budgetary restrictions to permanently monitor the use and conservation of water resources, especially to monitor aquifers and manage different basins. It only monitors the critical basins, such as the basin of the Tebicuary River and the Patiño aquifer; It cannot issue reports at the national level, as required for SDG 6.

These difficulties are also detailed in Paraguay's SDG 6 reports where, of the 11 indicators, only 2 have been developed and 9 are pending. Several indicators in which MADES intervenes prioritize satellite images, without resources to monitor the use of underground water resources with a broader network of measurement and reporting instruments. This shows the need to establish strategic partnerships with public and private sector stakeholders who represent the interests of the users of each basin and surface water resources.

Thus, to report on indicators **6.1.1** and **6.2.1**, only the EPHC has a permanent periodicity, while studies such as the MICS of 2016 do not have a defined periodicity and their implementation costs may be high. However, considering the importance of the information it provides on the quality of the water consumed and the household sanitation system, it will be crucial for the DGEEC to count on these resources to implement them as regularly as necessary.

Regarding information on *access to safe drinking water and adequate household sanitation*, the main information systems that may complement the regular information of the EPHC and currently are under the process of consolidation, are the SIU of the regulator and the SIASAR of the MOPC (with the support of the Committee set up for its implementation). At all times, it is important to ensure the complementarity of both systems, otherwise, the huge efforts will continue to yield partial information:

- The SIU covers all the country´s systems but does not capture the full spectrum of access to safe drinking water and adequate

sanitation sources. For example, in terms of sanitation, only the provision of sewerage networks is considered, whose regulation is in charge of the regulator. No other sanitation solutions have been considered.

- SIASAR faces the challenge of generating a large amount of information, but only at the rural level, neglecting the urban sector that concentrates the largest proportion of population.

The role of the CICOSAPS is essential when implementing and consolidating both systems because the efforts and contributions of various member institutions of the Committee will be required, without duplication of their efforts. Other essential actors for the provision of information through both systems are local governments (departmental governments and municipalities),

which will be fundamental to consolidate the SIU and the SIASAR.

To promote a more active role for local governments, MOPC and ERSSAN are now promoting the creation of Water & Sanitation Units within the structure of these governments. This is a fundamental strategy that could also be used to promote a more comprehensive vision on the sustainability of water usage, and not solely for the provision of drinking water and sanitation services.

Related to these initiatives, the STP promotes the elaboration and implementation of land-use plans in the country's municipalities, and as a result, an opportunity arises to coordinate the strategies and efforts of various institutions, including MADES, in the promotion of a more active role in water and sanitation for local governments.

6. New Water-Related indicators, emphasizing the 2030 Agenda and the 2030 NDP

To monitor and report on SDG 6 indicators, it is important to strengthen the complementarity of the SIU and SIASAR systems, to generate and maintain updated indicators at the national level on access to safe drinking water and sanitation services, that can complement the information provided by household surveys of the DGEEC. The data provided by these systems will be of great value, especially to be up-to-date with the parameters of service quality and continuity, and users' perception of the service rendered.

Key aspects complement the definition of "risk-free services", which relate to the "sustainability" of the services and the capacity of service providers to supply medium and long-term quality services, at affordable prices and ensuring a financial break-even point. Awareness of these issues is important to generate strengthening and managing programs in the sector´s companies, which cannot be captured by the permanent household surveys.

Recommendations

Regarding this item, it is suggested to formulate new indicators to measure the sustainability of the systems in a relatively straightforward manner, if the operator has the following key capacities to ensure the continuity and quality of the service in the medium term:

- Measuring produced water
- Micro measurement percentage
- Arrears level
- Operating margin
- Indebtedness ratio
- Water analysis - periodicity
- 24 hours continuity

For community organizations (Water & Sanitation Community Boards and Commissions), the most numerous among existing operators, the following is added:

- Holding regular public accountability meetings
- Percentage (%) of Committee members renewed each period
- Percentage (%) of users who participate in the meetings

Although the SIASAR will provide sustainability indicators in the future, it is proposed to get a rough idea of the systems´sustainability by surveying a few relatively simple variables, which should be agreed by sector representatives.

Another indicator that could be implemented relates to the "Change in water use efficiency over time", for which it is suggested to measure the **Unaccounted Water Index in systems that supply the country's main urban centers (ESSAP and larger Boards)**.

For the **agricultural sector**, it is suggested to consult the MAG to develop an indicator to measure: *The percentage of hectares of farmland with efficient irrigation systems[3], compared to total hectares of crops with irrigation*.

For the **industrial sector**, with the support of the Ministry of Industry & Commerce (MIC), it is suggested to develop an indicator to measure the *Use of water in production processes in those industries that consume the most water (such as the Beverage Processing, Meat Processing, and Chemical sectors)*, relating it to the existing good practices for water consumption in these industries.

For the participation of local governments, both the MOPC and other institutions of the CICOSAPS, such as ERSSAN, promote that these institutions play a leading role in the sector, in support of the creation of Water & Sanitation Units (UASs).

One option of this strategy is to incorporate the STP and MADES in the strengthening of local governments, given that the STP has been encouraging governments to draw up Land-use Plans and providing training for this purpose, while MADES would be interested in local governments promoting the integral management of the resource, facilitating the proper functioning of the River Basin Councils.

Regarding the previous paragraph, it is highlighted that, at present, reporting on Indicator 6.5.1 "Degree of integrated water resources management implementation" includes providing the number of River Basin Councils with Management Plans. It is proposed to complement the above with the following indicator: *Level of implementation of the Basin Management Plan*.

Strengthening local governments in water resources management can improve the quality of plans and the involvement of all users, and above all, promote that each Council contemplates in its plan the resources to generate the information that is fundamental to monitor both the use and the availability of the resource in the basin.

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3. Amount of useful water for the crop that remains in the soil after irrigation, in relation to the total water used (Manual on the Calculation of Irrigation Efficiency, Ministry of Agriculture & Irrigation, Peru 2015).

7. Feasibility of sharing and generating complementarity of information among entities linked to the water sector

In regards to the information generated within entities linked to the water sector, fragmented and non-systematized information for statistical purposes prevails, especially because the institutions generate limited information for their internal management needs. Only some entities have databases and information systems, such as ERSSAN, DGEEC, MADES, ITAIPÚ, and recently the MOPC.

The survey shows that few institutions have information systems with relevant data:

1. The DGEEC, which has data on service coverage stemming from the EPHC, the most queried database to design investment programs for the sector.

2. The ERSSAN-managed SIU, which also provides coverage data, the service area of each registered provider, is widely queried by entities building new water systems or expand existing ones.

These are only the two information systems queried to plan new investments. SENASA does not have an information system, but it does have data on existing Water & Sanitation Community Boards and Commissions recorded in the administrative files of each location.

As for financing and execution of investments in water and sanitation, the Ministry of Finance has information on the investment projects approved by the Public Investment System and it follows up on the physical progress and financial execution of these projects, but only of institutions of the Central Government. Consequently, the MoF does not provide information on all spending on water and sanitation by state-run institutions.

In addition to the two main information sources, the SIASAR is a platform with little information to date, but it is planning to incorporate a large amount of information on existing services in rural areas. Given this scenario of scarce sectoral information, the creation of the CICOSAPS has been appropriate to coordinate its institutions´efforts to set up a sectoral information system.

In terms of water resources, as of 2019 MADES implements the SIAM database, where all its information on projects that use water is uploaded.

Consolidating a sectoral information system, that brings together the dimensions of the drinking water and sanitation with the dimension of water resource management, should not cause interoperability issues between the databases. Indeed, the Ministry of Information & Communications Technologies (MITIC), which is

part of the SIASAR Implementation Committee, will be able to cooperate by defining the fundamentals to ensure the interoperability between the existing databases.

This consolidation of a unified system requires agreement on, and implementation of, a specific work plan within the CICOSAPS, which includes:

a. A definition of the key sector-wide information required, specifying the level of detail and regularity, based on the needs arising from the SDGs, the NDP 2030, and the sectoral and institutional plans in force.

b. Sharing the information available to date and ensuring interoperability between the SIU and the SIASAR is essential to complement efforts.

c. In regards to water resources, a different strategy is suggested to the MADES as it does not have the required capacities to generate a comprehensive monitoring system of the use of surface and underground water resources. The creation of strategic partnerships with other public and private institutions, to reduce their lack of capacities to collect and update data is proposed. The MADES would be able to contribute with data for the production of timely information because, as frequent users of the resource, they would be very interested in the availability of relevant information.

The work plan to share and generate information should join efforts to avoid surveys´duplication, based on the strategic partnerships established by the institutions as part of a unified information

system. Proper implementation of the SIU and SIASAR systems will require considerable efforts by the institutions involved. Therefore, it is necessary to coordinate the data collection on common issues, referring to data from service providers, to the characteristics of the physical infrastructure of the water and sanitation systems, among others.

The process to consolidate the information

- In the initial stage, for the coordination of the CICOSAPS, it is important to share information on the requirements of both systems and ensure the interoperability of the databases.

- In the second phase, common criteria needs to be defined on the methodology and strategies to gather information in both systems, to agree on a work plan, and identify each institution´s contributions or those that may come from external cooperation.

- The strategy and actions should be coordinated to ensure that the information is shared and updated with an adequate regularity, visualizing the key role local governments could play and the use of new technologies allowing real-time reporting.

Everything described herein is to underscore that, although different systems coexist, they must operate and generate information based on common criteria and function as a unified information system.

8. Conclusions and recommendations

1. There is very little information systematized and easily accessible by all institutions in the sector.

2. Most of the institutions do not assign substantial resources to build capacities for the systematic generation, validation, and publication of information.

3. Institutions only prioritize the generation and use of the information that they employ in their action plans. Therefore, the information available is very fragmented and lacks adequate systematization.

4. Considering that the coordination and integrated planning of the sector is incipient, the institutions are undertaking a change in their institutional culture aimed at sharing information, while embracing common criteria for the generation and dissemination of information.

5. Several important efforts to collect relevant information regarding the quality of drinking water and sanitation in households, and on the availability and hydrological balance of critical water basins, among others, have been part of specific projects and consultancies, whose continuity is not guaranteed to serve as a means of permanent monitoring, as is the case with the following initiatives:

   a. Program "Sembrando Oportunidades (STP)", 2014-2017
   b. National Survey on the Quality of Water and Sanitation Services (UN-DGEEC Joint Programme), 2010
   c. Rapid Water Quality Assessment (UN Joint Programme), 2011
   d. Project PMSAS 77/10-SEAM. Tebicuary River Basin Report, 2018

   e. Elaboration of the Surface Water Balance of the Plata Basin (Paraguayan territory), 2016
   f. Multiple Indicator Cluster Survey, MICS PARAGUAY, conducted in 2016 by the DGEEC

6. The permanent source of information, with greater coverage and defined regularity, is the Continuous Permanent Household Survey, however, as it measures a wide range of socioeconomic and demographic indicators, it cannot collect information on many other variables related to the status of the drinking water and sanitation service.

7. Regarding the provision of drinking water and sanitation services, there are only two disaggregated databases on systems, providers, and rate and quality parameters: the SIU -managed by ERSSAN- and the SIASAR -managed by MOPC. The former has been up and running for a few years and is the database with the most information on the status of the water and sewerage services, while the implementation of the latter is recent and does not contain much information yet.

8. Regarding water resources, the hydrological stations of the MADES monitor the levels and flows of prioritized surface waters: Lake Ypacaraí, Yhaguy River, Capiibary River, and Pirapó River, permanent monitoring systems of a critical basin (the basin of the Tebicuary River) and the Patiño aquifer.

9. Regarding the levels of the main rivers, several institutions have hydrological stations that measure the level and flow of the Paraná and Paraguay Rivers, measurements that are disseminated mainly through the DMH website.

It is also noted that the Itaipú and Yacyretá hydroelectric dams have automated systems to measure the level of their reservoirs and adjacent waters.

10. Since 2019, the MADES also implements its SIAM database, where all the information on projects seeking an Environmental License is uploaded, including all the information on their use of water resources.

Under this scenario, it is important to recognize that all institutions have resources limitations to generate systematize and updated information. Therefore, a clear agreement is required to move towards the consolidation of a single information system, providing economies of scope to the collection, validation, dissemination, and updating of information. Several institutions make isolated attempts to collect information for their purposes, but most of them are limited to a few communities and systems due to a lack of resources.

The CICOSAPS seems to be the body available to facilitate these agreements at the level of water and sanitation services, proposing a work plan which includes:

a. Definition of the key sectoral information, with the level of detail and regularity required, based on the needs of the SDGs, the NDP 2030, or the sectoral and institutional plans in force.

b. It is indispensable to share the information already available, and ensure the interoperability between systems to complement efforts.

c. Definition of each institution's role in the provision, validation, dissemination, and updating of information.

d. Determine the resource requirements and their origin, considering the contribution of

each institution and what might come from cooperation sources with the private sector and international cooperation actors.

e. Consider the role that local governments, and even the communities and operators, could play through self-reporting systems.

Regarding water resources, it is important to highlight the experience developed by the DMH, MADES, MAG, the National Administration of Navigation & Ports (ANNP), the Navy and Itaipú as these institutions share all the information collected by their hydrological stations and wells-monitoring in the Patiño aquifer, information that is posted on the DMH website for all interested users. Similarly, the Yrato Project, managed by the ITAIPÚ Hydro-Informatics Information Center, which posts the hydrological information provided by these institutions on its website.

The work plan to share and generate the necessary information must join efforts to avoid duplication of the surveys and to create strategic partnerships for institutions to operate as part of a unified information system. Proper implementation of systems, such as the SIU and SIASAR, will require significant efforts by the institutions involved. Therefore, it is necessary to coordinate the collection of information and consider updating strategies.

As mentioned above, several institutions are promoting the creation of Water & Sanitation Units in each municipality, therefore, the role of local governments will be of vital importance, without neglecting what each community and operator can report, reducing the cost to update the information. For this purpose, the use of technological tools to report through mobile applications is important, as is the case of the mobile SIASAR: An application designed for mobile devices and tablets with the Android operating system. The main purpose of this tool is to collect data.

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Annex

1. Ministry of Environment & Sustainable Development (MADES)

Information systems or sources generated in the institution	Indicators that are built with this information system
Surface Water System that includes monitoring sensors from MADES, DINAC (DMH), ANNP, and Navy	– Average monthly Rivers flow – Average monthly hydrometric rivers level
Groundwater Monitoring of the Patiño aquifer	– Groundwater quality – Wells levels
Monitoring the Tebicuary River Basin	Level of water resources availability: – Permits for agricultural use – Water Stress Level
Consultancy for the elaboration of the surface water balance, 2018	– Surface water balance
Environmental Information System (SIAM)	– The number of approved projects by departments – Number of approved projects by basin – Water uses from approved projects – Approved extraction volume per basin
Agreements with neighboring countries for managing cross-border basins approved and statutory	– Transboundary basins with an operational arrangement for water cooperation
Local Water Boards	– Number of river basin plans for the implementation of integrated water resources management

2. National Environmental Sanitation Service

Information systems or sources generated in the institution	Indicators that are built with this information system
Form-based structured interviews in Drinking Water Systems	– Percentage of systems that have micro-meters – Percentage of systems that have chlorinated water
Report on water and sanitation services in Family Health Units (USF) in the Chaco	– USFs that have services – Coverage rate in communities
Report on community management of water boards and commissions	– Number of Boards with proper management

3. Ministry of Education

Information systems or sources generated in the institution	Indicators that are built with this information system
School Infrastructure Form 10 (PIE - 10) by Principals, 2008	– % of institutions with health infrastructure – % of institutions with differentiated bathrooms
Single Student Registration and Educational Institutions, 2017 and 2019	– % of schools that need investment

4. MOPC / DAPSAN

Information systems or sources generated in the institution	Indicators that are built with this information system
Rural Water and Sanitation Information System (SIASAR)	The SIASAR produces an aggregate general index: 1. Water and Sanitation Services Performance Index (IAS) based on two partial indexes which are: • Water, Sanitation and Hygiene service level (NASH) • Water Services Sustainability Index (ISSA)
Providers' request to change tariffs	– % of cost coverage – Profitability
Registration of projects, in their different stages: • Pre-investment • Execution • Operation	Performance indicators: – Internal Social Return Rate – Net Social Present Value – Benefit/Cost – % of the physical progress of works – % of financial execution
Information on communities, systems, and providers	– Currently, no indicators are built with the information

5. Meteorology & Hydrology Directorate

Information systems or sources generated in the institution	Indicators that are built with this information system
Sensor report measuring the level of accumulated rainfall	– Accumulated rainfall
River level	– Height of river
The water level in deep wells	– Height of water
Agricultural Water Balance Platform	Percentage of Useful Water Content • Drought • Moderate Deficit • Deficit Mild • Adequate Reserve • Optimal Reserve • Water excess

6. Itaipú Binacional

Information systems or sources generated in the institution	Indicators that are built with this information system
Hydrological Monitoring and Early Warning System for Paraguay (YRATO)	– Critical levels – Alert levels
Ypacaraí Lake Monitor	– Average monthly level
Telemetric system for rivers and water bodies level	– Average monthly level – Average monthly flow
Telemetry system in the reservoir area and water quality	– Average river level – Sediment and nutrient level
Pluviometric stations in the reservoir area	– Accumulated rainfall
Water Services Division records Contracts for the construction or improvement of drinking water systems and treatment plants	– System coverage – Amount of investment per beneficiary

7. Technical Planning Secretariat

Information systems or sources generated in the institution	Indicators that are built with this information system
The program *"Sembrando Oportunidades"*	– Coverage rate in selected communities – Investment amounts allocated to water and sanitation projects – Number of beneficiaries

8. General Directorate of Statistics Surveys & Censuses (DGEEC)

Information systems or sources generated in the institution	Indicators that are built with this information system
Permanent Household Survey (EPHC, for its Spanish acronym)	1. The proportion of the population with improved water supply services 2. The proportion of the population with access to safe drinking water, potentially managed 3. The proportion of the population using improved sanitation
Multiple Indicator Cluster Survey (MIC'S, for its Spanish acronym)	1. Percentage of household population with an improved water source within the home, yard, or lot, free from E. coli and sufficiently available 2. Percentage of household members using improved sanitation facilities that are not shared 3. Percentage of households that have a facility for handwashing with soap and water

9. Water Services Regulator (ERSSAN)

Information systems or sources generated in the institution	Indicators that are built with this information system
Unified Information System (SIU)	– % of formalized operators – Service coverage by municipality and department – Systems underground and surface collection – % of systems that treat water – Micro-measurement index – Water distributed/ Water invoiced = ANC Index – Collectability rate (collected/invoiced x 100)
Annual monitoring plan	– Quality of the water provided – Continuity of the service
Service quality regulatory framework compliance reports	– Percentage of performed analysis – Percentage of compliant determinations – Percentage of delivery compliance with the minimum set pressure – Percentage of delivery compliance with the maximum set pressure – The average duration of interruptions – Disruption magnitude indicator – Equivalent interruption duration – Continuity Index – Overflow magnitude indicator – Network affected by dry weather overflows – % of Conforming Samples – Micro-measurement index – Collectability index – Unaccounted for Water – Per capita consumption – Efficiency rate: Number of staff per 1,000 connections

10. Rural Development Institute

Information systems or sources generated in the institution	Indicators that are built with this information system
Administrative records with technical information on water and sanitation systems	– The institution does not formulate or report indicators
Administrative records with social information on the beneficiary communities	– The institution does not formulate or report indicators
The administrative record of Board Resolutions, formal recognition of Neighborhood Committees requesting construction of water systems	– The institution does not formulate or report indicators

11. Ministry of Finance

Information systems or sources generated in the institution	Indicators that are built with this information system
Project Bank of Public Investment System	Social Profitability Indicators: – Internal Return Rate Net Present Value – BENEFIT/COST – % of physical execution – % of financial execution of projects

12. Yacyretá Binational Hydroelectric Dam

Information systems or sources generated in the institution	Indicators that are built with this information system
Monitoring network in the Yacyretá Dam Influence Area. Main course. MD Index Stations	Quality indicators included: – 28 parameters, physical-chemical, biological and bacteriological
Monitoring of Encarnación Urban Streams - Sub-dams formed at Final Operating Level of 83.0 MSNM	
Monitoring of MD Sub-Dams. Trophic Condition	
Monitoring Brazo Aña Cua downstream of Yacyretá Reservoir	

13. Water Service Company - ESSAP

Information systems or sources generated in the institution	Indicators that are built with this information system
The commercial system, where commercial data are recorded in COBOL programming language	1. Collection Efficiency 2. Delayed payment 3. Unbilled Water 4. Micro-measurement index
Land registry system	– Population with sanitary sewerage – Population with water service
SCADA system	– Productivity Indicators

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