An Integrated Approach for Water Statistics

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1. Introduction

The increased importance of water statistics as a global concern is identifiable in various international contexts. Just to mention one, the Millenium Development Goal (MDG) no. 7 "Ensure environmental sustainability" aims to integrate the principles of sustainable development into country policies and programmes, reverse loss of environmental resources and to reduce by half the proportion of people without sustainable access to safe drinking water.

Water statistics are important not only for reporting obligations to international organizations (UNSD/UNEP, Eurostat/OECD) but also, possibly first of all, for national management of environmental and socio–economic conditions needed for sustainable development.

Using a definition familiar to economists, when the **"break even point"** is reached, that is to say that the **used water exceeds the renewable water resources**, there is definitively **no sustainability**.

The impact of a good rainy season on agricultural output (and on GDP) is well known, as is the importance of access to safe water to prevent diseases, especially in developing countries. Still, within National Statistical Systems, environmental statistics, including water statistics, do not receive appropriate consideration.

The lack of appropriate consideration of water statistics could be a due to local priorities, scarce financial resources or a lack of specialized skills. Often it is a combination of these factors or additional factors such as poor administrative data for environmental statistical purposes. In some cases the major problem seems to be a lack of awareness.

2. Background

Romania is expected to join the European Union in 2007. Before it can do so, it must comply with existing EU legislation, including statistical legislation. The EU's PHARE project "Compliance of Romanian Statistics with the European Statistical System" was set up to help Romania meet the EU's demand for statistics. This project included financial support from the EU and technical support by twinning with the EU member state, Italy.
The intention of this paper is mainly to present and share the experience of Romania where pilot environmental surveys on waste and water were run during 2003/2004.

The design of the water survey, and the methodological approach, started from an analysis of the European requirements, beginning with the EU's Water Framework Directive. The

purpose of the Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater.

Even if the Directive does not specify statistical activities for data collection, as such, but the topics of interest for data collection are indicated. In particular, the Water Framework Directive requires each Member State to:

- analyse the characteristics of each river basin district (or for the portion of an international river basin district falling within its territory) (Article 5),
- review the impact of human activity on the status of both surface and ground water; and
- carry out an economic analysis of water use.

Moreover, all bodies of water used for the abstraction of more than 100 m^3 of water a day for human consumption, must be monitored. Programmes to monitor the status of both surface and ground water must be established. These will be covered in the presentation by WRc, and so are not repeated here. Where monitoring reveals problems, a programme of measures to tackle these problems must be established.

3. Romania's water resources

In a territory of over 230,000 square kilometres, with a population density of less than 100 inhabitants per km^2 and where around one third of the working population works in agriculture, Romania's water resources are relatively poor and unequally distributed in time and space, being formed of surface waters (inland rivers, lakes and reservoirs, and the Danube River) and of ground waters. Black Sea water resources, although very important, cannot be taken into account for the time being because of the technical and economic difficulties in seawater desalination. The ground waters, which are generally of better quality than the surface waters, are estimated at an available annual amount of 9 billion m^3, of which about 3 billion m^3 can be used under existing technical and economic conditions.

Romania receives 85 billion m^3/year from the Danube River, but the possibilities for their actual use are limited because the river is used for navigation. Thus, only 30 billion m^3/year can contribute to the water stock that is technically available for consumption. The Danube flows alongside Romanian territory, with 37% of its length forming the Southern boundary of the country. The Danube river has already acquired significant pollutants before it reaches Romania, because upstream of the delta it receives water from 17 countries throughout its 2,800 km length. The quality of the Danube's water is adversely affected by diffuse and point source pollution throughout its catchment area. Agricultural pollution and untreated discharge from municipal and industrial sources have a negative effect on the Danube, both directly (riparian sources) and indirectly (via its tributaries).

4. The water survey in Romania

The main statistical reference was the **Eurostat/OECD Joint Questionnaire** on inland waters. The most relevant parts of interest of the JQ questionnaire were included in the Romanian water survey. These were:

- Annual water abstraction by source and by sector (table 2)
- Water use by supply category and by sector (table 3)
- National population connected to waste water treatment plants (table 4)

- Treatment capacity of waste water treatment plants (table 5)
- Generation and discharge of waste water,
    - in terms of volume (table 7.1)
    - in terms of BOD, biochemical oxygen demand (table 7.2)

With the objective to produce the data a comprehensive working group was created including the INS (National Statistical Institute), the MMGA (Ministry of Environment and Water Management) and other important Romanian water authorities such as "Apele Romane" (Romanian Waters).*

The main objective of the direct survey on water, whose **pilot** was conducted for the **Mures river basin, reference year 2003**, was to achieve unitary and coherent data collection on water flow (abstraction, supply, discharge and processing system) from specialized units, industrial units and the agriculture sector.

This was done by means of three different direct surveys:

- Specialized Units performing Water Abstraction and Use and/or Urban Wastewater Collection, Treatment and Discharge for public purposes were investigated using a questionnaire named "AS-A-SER" (Ancheta Statistica – Apa – Servicii)
- Industries involved in Water Use and Supply (by means of source) and/or Wastewater Generation, Collection and Discharge used a questionnaire named "AS-A-IND" (Ancheta Statistica – Apa – Industrie)
- Agricultural enterprises performing irrigation were observed on sampling base (but exhaustively for irrigated surface of over 100 hectares) and related questionnaire named "AS-A-IRR" (Ancheta Statistica – Apa – Irrigatii)

Information on the results, more details about methodology - including the questionnaires used - may be illustrated by the INS delegate.

Briefly, **Specialized Units** (NACE code 41) were investigated in an exhaustive manner. A common section for identification data and economic information (employees and turnover) was in the questionnaire introduction. Part A of the questionnaire was filled in by all specialized units for Water Abstraction, Purification and Distribution and included a section on Storages location and capacity. Part B was filled by units dealing with Urban Wastewater Collecting, Treatment and Discharge and included a sludge management table.

The survey on Industries was implemented using both census (exhaustive) and sampling technique (stratified sampling on activity code - NACE classification - and employees' size class) using as a frame the statistical Business Register (REGIS).
The **industrial sub population** surveyed on a census base included all local units matching at least one of the following two characteristics:

* the methodological first and main input was given by Prof. Giorgio Alleva, member of the Italian COMSTAT; the actual implementation of the survey has been realized by a consortium led by LDK Environmental Consultants SA. The coordination and monitoring role has been ensured by Romanian environmental statistics working group at the National Statistical Institute of Romania (INS) leaded by the environment PHARE project component manager Mr. Constantin Mindricelu.

- Units of economic activity (industry and service) with more than 500 employees;
- Units from categories of economic activity (according to the NACE economic activity classification) that are particularly relevant in terms of water abstraction, water consumption or wastewater generation (i.e. NACE code 40, Electricity …)

The sub population surveyed by means of a stratified sample included:
- all local units of the survey frame that are not included in the aforementioned sub population investigated on a census base.

Enterprises of less than 5 employees were excluded from the population, to reduce response burdens and costs. The questionnaire for industrial units included sections on Water Source, Water Use, Wastewater Generation and Discharge, but also on Industrial Wastewater Treatment Plant.

The frame for the specific survey on **agricultural enterprises** performing irrigation was deducted from the agricultural census applying a threshold of minimum 1 hectare of irrigated surface and was, of course, focused on quantity of water used for irrigation purposes.

To enlarge the coverage of the water use survey in agriculture, specifically in the zoo-technical sector, water consumption by different kind of animals was estimated using coefficients for water use in relation to stocks of animals. Data on stocks of animals was available from the agricultural census and its updates. Coefficients used in the estimates were derived using international standards provided by FAO and ILRI (International Livestock Research Institute).

5. The importance of integration

The discussions held in the analysis team led to some additional interesting perspectives, a few of them beyond the initial objectives. In this conference we are presenting some of them hoping they can make a contribution to the debate and eventually help other countries in their approach to water statistics.

Generalizing the feedback, we can affirm that the lesson learned is that **the integration of different data sources and methodologies should be pursued to broaden coverage, add consistency to data, allow validation, improve cost effectiveness, and deepen data analysis.**

For instance, during the analysis of the preliminary results in Romania, it was noticed that some significant areas (in terms of size and inhabitants) were not served by Specialized Units, mainly in the rural areas. In order to have a more complete coverage, an additional effort was made to estimate with coefficients the household water consumption and waste water generated not-covered by specialized units.

This added a new data to the water survey. "S*erved population*" information (water consumption and waste water generated) was derived from direct environment questionnaire answers of specialized units, the same information for "not *served population*" (mainly rural

areas) was estimated applying coefficients to population data from census and its further updates. For the area covered by specialized units (and so by the direct environmental survey, mainly the urban areas), the **"mirror statistics"** of estimation with coefficients supported data consistency validation having in mind the dimension of "coherence" as defined in Eurostat guidelines on quality.

So, from the methodological point of view, we can assert that all the three main pillars of the statistical data administered by a national statistical institute were used: population, business register, and agricultural-territorial data.

Integration of the three databases in a single information system and possibly into a corporate-wide database, as suggested by the Conference of European Statisticians debating on Information Systems Architecture for National and International Statistical Offices, and the possible subsequent representation over a geographical information system (GIS) can, among the others, also help the production of statistics at finer NUTS level (local) and allow more effective representation of territorial and environmental information.

A practical example is the amount of emissions to the air of a given gas in a country may be irrelevant if there is a wide dispersion but lethal if concentrated. The exact localization of each waste landfill or water reservoir (possibly through Global Positioning System, GPS) provides additional very effective information not included in the total amounts of stocks at regional or basin level.

This approach is followed by the *European Environment Agency* (EEA), which through its specialised European Topic Centres collects environmental information on topics such as air emissions, land cover, water, and nature/biodiversity. In particular, the CORINE landcover inventories provide a basis for representing statistics on a more detailed spatial level as well as being a source of basic data needed to compile indicators on changes in the landscape.

The Romanian pilot project was an interesting laboratory and possible future developments are already a matter of discussion. One future development would be integration with other important data sources such as "Apele Romane" (National Administration Romanian Waters) and INHGA (National Institution of Hydrology and Water Management) towards a more extended coverage of the phenomenon including:

- Water precipitation (quantity and rain days)
- Number, localization, storage potential and actual stock (beginning and end of year) of water reservoir
- Estimate of water loss (leakage, evaporations …)

Cross analyses with other domains are under investigation such as GDP evolution (and specifically agriculture contribution) against rainfall and/or variation of stock in the reservoir.

Impact of water scarcity on the energy sector is being investigated. As a matter of fact the only nuclear power plant in Romania, at Cernavoda, was closed at the end of summer 2003 for about one month due to the low level of water in the Danube river.

Preliminary evidence suggest as key indicators, under human management, the total "capacity" of the reservoir and the efficiency of the Specialized Units in the water distribution and delivery (rate of water lost). Cost-benefit analyses may show the how much stocks held in reservoirs should be increased to avoid negative impact on agricultural and energetic output in dry years and what is the maximum affordable rate of water lost in the distribution (before intervening in the improvement of the water- pipe networks) .

6. Sharable outcomes and proposals

The specific pilot environmental direct water survey run in Romania can be considered a very interesting experience to which other transitional or developing countries can refer in their own approach to water statistic surveys.

To support countries having financial and human constraints in developing targeted environmental surveys the interagency working group on environment statistics may consider the opportunity to advance researches on indirect **coefficients** in topic groups at core level.

Refinements in this sense are necessary; talking about the livestock water use (total quantity of water required by animals for their metabolic processes as well as for the heat regulation of their body), it is perceivable that it varies according to a number of factors such as sex, age, food intake, quality of the food, and air and water temperature.

For households it could be useful to estimate the amount of waste water generated as percentage of water used (urban and rural).

Of course, it is fundamental to figure out the **water use intensity** (*use of m3 water per euro1000 output)* **by crop** in the agricultural sector. But also in the industrial sector it could be convenient to investigate water use intensity and waste water generated **by economic activity** (NACE code).

The coefficients can be used to make estimates when it is not possible to survey or capture data. Coefficients are also useful for planning and monitoring in the agricultural sector and the industrial sector. For example, "***overwatering"*** due to inefficient processes and technologies can be detected in places where water use intensity is much higher than the sector average (coefficient).

Promotion and incentives for water saving activities and processes, that reduce water use, could be **a policy for helping the sustainability.**

If there are only scarce resources available for a National Statistical Institute to conduct a water survey we would suggest focusing on the most important survey, which is the one targeting Specialized Units performing Water Abstraction and Use & Wastewater Collection, Treatment and Discharge for public purposes (NACE code 41) that the Romanians covered with the "AS-A-SER" (Ancheta Statistica – Apa – Servicii) questionnaire. The total number of such specialized units in developing countries is normally very low, and I would assume

that they number less than 100 units even in countries with up to 50 millions inhabitants and an area of 500,000 squared kilometres.

Other water information requirements could be covered, at a low cost, including specific water questions in other statistical operations.

Basic social information like Population connected to public water supply and waste water collection could be collected by few questions in **living standard** household surveys.

Requesting the water used for irrigation in **agriculture surveys** could bring more benefit than burden; in the same way **business** structural **survey** can address the problem of water use and supply (by means of source), wastewater generation, collection and discharge.

We would like to conclude this short paper proposing for debate some sustainable water indicators that we first presented in the November 2004 MEXSAI Cancun Conference on Agriculture Sustainable Indicators.

Water retainment efficiency:
Quantity of rainfall retained for subsequent human management (increase in stocks, net of consumption) over rainfall (*a rate far from 1 denotes inefficiency in the use of potential resources in terms of catchments and/or storage).*

Water distribution and delivery efficiency:
Water consumption at the served clients (households, industries and farms) over water effectively put in the water pipe network by Specialized Units (*a rate far from 1 denotes high water leakages in the distribution network).*

As a general background we like to remind reader of some standard criteria for choosing environmental indicators:

- *policy-relevance* – address the key environmental issues
- *responsiveness* – change sufficiently quickly in response to action
- *analytical soundness* – based on sound science
- *measurability* – feasible in terms of current or planned data availability
- *ease of interpretation* – communicate essential information in a way that is unambiguous and easy to understand;
- *cost effectiveness* – costs in proportion to the value of information derived