Annex 1.1

Elements of a methodology for monitoring and management of water-related information for improved decision making

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Project: Strengthening national water monitoring capacities, with emphasis on agricultural water management (GCP/GLO/207/ITA)

Elements of a methodology for monitoring and management of water-related information for improved decision making

The aim of the methodology is to provide an overview of the situation of the water resources in the country and the water management situation, with a view to providing decision makers in the government and other organizations in water management with up-to-date information to monitor the state of water resources and prioritise investments in the water sector.

To this end, the project will identify, analyze and publish water-related information at three different levels: Country, basin and local level. Care will be taken that there is full consistency with existing information systems on water resources in the countries as well as with AQUASTAT, FAO's global information system on water and agriculture.

The methodology should provide a reasonably accurate picture of the situation of water resources, the uses to which water is put, and the economic, social, environmental and health implications of agricultural water management. It should be designed to be easily applied and adapted by the relevant institutions at the national level, which have limited personnel and resources. That means the methodology must be as simple as possible and draw as much as possible on readily available data in order to minimize the cost of application and updating at regular intervals. An interval of 5 years is suggested.

Due to the constraints of the present project in terms of time and resources, the methodology will only be applied on a pilot basis in both countries in one river basin and, within the basin, in selected pilot areas at the local level. This exercise will provide updated information to be included in the water resources and use database to be developed under the project, as well as feedback regarding the wider applicability of the methodology in other river basins in the country after the project has ended.

1. National level

At the national level, a number of variables and indicators should be selected which provide aggregated information on (i) the overall country context relevant to the water sector, (ii) the state of water resource, (iii) the water use sectors and (iv) the performance of the water management system. The indicators will be included in the database.

- Basic country data relevant to the water sector
    - Population
    - Livelihood and health
    - Economy
    - Investment
- Characteristics of water use sectors
    - Agriculture and irrigation
    - Fisheries and livestock
    - Cities/Municipalities
    - Industry
    - Energy production

- Freshwater Resources
    - Water resources and development
    - Water uses
    - Sources of water used
- Performance indicators
    - Water supply coverage
    - Sanitation coverage
    - Irrigation management
    - Social impact of water management
    - Environmental impact of water management

In selecting the indicators to be included in the methodology, care must be taken that they are meaningful and they can be computed on the basis of easily available information, to allow an easy updating of the database at regular intervals by the relevant institutions at the national level. In the context of the project, focus will be on the definition on indicators for agricultural water management.

If possible, the information should be complemented by relevant thematic maps, such as:

- water supply and sanitation coverage,
- water use per sector,
- population density,
- economic activity of the population per sector (agriculture, industry services),
- river basins and aquifers,
- water courses (rivers, lakes, wetlands),
- irrigated areas,
- dams,
- protected areas,
- land use / land cover,
- climate

2. River basin level

At the basin level, two results are envisioned: A water balance study and a river basin profile.

2.1 Water balance study

Aim of the water balance study is to get an up-to-date picture of the available water resources in the basin and the uses to which they are put, using, to the extent possible, regularly updated data from national sources which would allow a repetition of the exercise at regular intervals. The idea is to develop a low-cost methodology which gives a reasonably accurate picture and which can be easily replicated in the other basins of the countries.

The methodology for the water balance study for the river basins could be adapted from the study "Water Resources and Irrigation in Africa" (FAO Land and Water Digital Media Series No. 13) (http://www.fao.org/nr/water/aquastat/watresafrica/index.stm)

To the extent possible, secondary data should come from national sources (Ministry of Water Resources, Ministry of Agriculture, Central Statistical Agency, River Basin Master Plans etc etc.). Where this is not possible, secondary data from international sources can be obtained (for a list of the data sources of the FAO study, see
http://www.fao.org/nr/water/aquastat/watresafrica/index3.stm)

The data requirements are as follows:

- Hydrometeorological data (Precipitation, Reference Evapotranspiration)
- Climate data
- Topographical data
- Soil data (soil moisture)
- Hydrological data (river network, runoff)
- Water use data:
    - Domestic use
    - Agriculture and livestock
    - Fisheries / aquaculture (if relevant)
    - Industry
    - Electricity
- Dams and reservoirs and evaporation from artificial lakes

Secondary data to compute agricultural water use:

- Cultivated area
- Cropping patterns and calendars for different agro-ecological zones in the basin
- Irrigated area
- Irrigation technology (surface, sprinkler, localised)
- Other water control systems (see AQUASTAT irrigation categories)

Secondary data to compute domestic water use:

- population density
- access to water and sanitation (piped /non-piped)

Secondary data to calculate industrial water use

Furthermore, the analysis of satellite images may provide additional information on the location of irrigated areas and actual evapotranspiration.

It should be assessed if and how the data collected in the field survey (see section 3) can be meaningfully extrapolated to the basin level in order to generate more accurate estimates on area under water control, especially with regard to informal irrigation and water harvesting structures, as well as the area actually irrigated in formal irrigation schemes.

2.2 River basin profile

The aim of the river basin profile is to provide a concise overview of the water resources situation in the basin based on the results of the water balance study and secondary data. It should follow a clear, standardized format and provide information relevant for decision makers at the national, regional and local levels.

It is proposed that the structure is based on the AQUASTAT country profile. It should highlight problems and issues demanding urgent action by the government and other stakeholders in water management, for example

- if water demand exceeds supply (groundwater overdraft, allocation problems),
- if actual irrigated area is considerably below area equipped for irrigation;
- if there are water quality problems which pose a problem for current or future uses,
- environmental issues which need to be addressed (pollution, salinization)
- health issues (water-related diseases)

The profile should be illustrated by thematic maps produced on the basis of the water balance study.

3. Local level

The aim of the field surveys is to assess the relative importance of different water control systems (formal and informal irrigation, water harvesting) in selected pilot areas within the basins. In particular, data on informal irrigation schemes, which are not usually included in official statistics, should be collected. With regard to formal irrigation schemes, it is important to assess how much of the area equipped for irrigation is actually irrigated and what crops in order to get more accurate estimates of water used in these schemes. Thus, the results can be used to assess the accuracy of official figures on irrigated area and agriculture.

The design of the questionnaires should be easy and straightforward so that they can be filled out by local extension agents during their regular visits to the farmers. The idea is to develop a low-cost methodology for rapid appraisal of water-related information at the local level which can be replicated and regularly applied in all regions of the country, in order to improve the availability of reliable data on agricultural water use. It should not be attempted to

The pilot areas should be logical entities with clear economic and environmental boundary conditions. They should be chosen according to the following criteria:

- be representative of the different agro-ecological zones in the basin,
- contain both formal and informal irrigation schemes,
- contain other forms of water control (water harvesting)
- encompass peri-urban irrigated agriculture

Information on peri-urban agriculture is of particular interest as there is little and contradictory information on the subject.

The following data should be collected during the field surveys in the pilot areas:

- Inventory of water control schemes (georeferenced)
    - Irrigation (formal, informal)
    - Water harvesting (ponds, underground storage, and shallow hand dug wells as well as in-situ moisture conservation techniques)
    - Spate and flood recession
- Equipped / actually irrigated area
- Water sources of irrigation (surface water, groundwater, mixed, wastewater, agricultural drainage water)
- Cropping pattern and calendar
- Yields from rainfed / irrigated agriculture (this data is of particular interest since there is very little information available)
- Environmental and health issues related to water management
    - Area affected by salinization / waterlogging (irrigated/non-irrigated)
    - Prevalence of water-related diseases
- What is done with the irrigated products (own consumption, sold and if yes where, distance to market, etc.)

Furthermore, data on social impacts of water management should be collected, such as:

- Access to water resources, to land resources, to irrigation, etc. of different groups (poor people, ethnic groups, women) – gender-disaggregated data is of particular interest.
- Existence of water-related conflicts and local mechanisms to solve them

The location of the water control schemes will be recorded with a GPS device to allow the inclusion of the data in a GIS database for geospatial analysis.

A report will be prepared presenting the results in each pilot area. It should include a comparison with official data on agricultural water use (particular irrigation) in the pilot areas, to show the differences, if any, between official data and the reality in the field. It should be complemented by relevant maps.

Available Resources:

- AQUSTAT methodology for data collection on water use for agriculture and rural development
  http://www.fao.org/nr/water/aquastat/background/index.stm
- Methodology for the Survey of Current and Projected Water Use in Irrigated and Rainfed Agriculture, FAO Project "Information Products for Nile Basin Water Resources Management" (GCP/INT/945/ITA)
- Methodology for the study "Water Resources and Irrigation in Africa":
  http://www.fao.org/nr/water/aquastat/watresafrica/index.stm
- World Water Development Report Indicators:
  http://www.unesco.org/water/wwap/wwdr/indicators/
- Standardized information on river basins: IUCN Atlas Watersheds of the World:
  http://www.iucn.org/about/work/programmes/water/resources/wp_resources_eatlas/