United Nations/Austria/European Space Agency
Symposium on "Water for the World: Space Solutions for Water Management"
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Working Group on the Development of a Pilot Project

ELEMENTS TO BE CONSIDERED FOR DEVELOPING AND IMPLEMENTING PILOT PROJECTS FOR WATER RESOURCE MANAGEMENT WITH THE USE OF SPACE APPLICATIONS[1]

1. Title and objectives

- **Title:** "Space technology in support to water resources management for poverty alleviation"

- **Objectives:**
  - Capacity-building
  - Protection of environment
  - Sustainable development of water resources
  - Sustainable development (economic, social, education, etc)

2. Timeframe

- Following the preparatory phase, the following timeframe is suggested for a pilot project:

- 3 years:	- Operation (development and implementation, including monitoring and evaluation as well as sharing of experience) - Baseline review - Mid-term review - Impact assessment review
- 1 year:	- Preparation for sustainable operations (starting already after the mid-term review).

3. Donor partners

- Donor partners can include, but be not limited to, the following:

  - Members and affiliates of the Committee on Earth Observations Satellites (CEOS)

  - Entities of the United Nations system

[1] National, regional and international entities initiating proposals for pilot projects should take a lead in developing, finalizing, fundraising and implementing pilot project proposals with the help of the advisory group to be composed of volunteering experts.

- World Bank
- Professional associations and scientific associations, such as ICSU
- Regional development banks
- Private sector
- Official Development Assistance (ODA)
- Other regional commissions (other than United Nations economic commissions)
- Water-related organizations

4. Partnership

- It is critical to promote broad participation of non-governmental organizations, universities and research institutions with data processing capability, and grass-roots partners.
  - Examples can be drawn from the Indian Space Research Organization (ISRO) project that involves personnel from the field. Grass-roots partners could make commitment by providing in-kind support, i.e. manpower, data collection, etc.

- For Africa, it is desirable to build upon existing regional partner networks, such as African Network of Basin Organizations (ANBO), and regional commissions, such as ECOWAS.

- Involvement of women organizations is important in view of the essential role that women play in development.

- It is important to involve donor/funding community to ensure funding of projects.

- The space community should be involved to ensure the sharing of best practices and up-to-date information about available space technologies that can be used for water resources management.

5. Recipients

- Relevant government institutions (on a cost sharing basis):
  - national/federal governments
  - regional/local authorities

- National and multi-national water management authorities

- Intergovernmental organizations
- Non-governmental organizations
- Community-based organizations
- Academia

A starting pre-condition should include agreement by the recipient institution of consideration of project results to make decisions on the possible operational use of space technology (project output).

India's (ISRO) experience: A multi-level partnership should be established between national/governmental agencies and local authorities and users. Governmental agencies should contribute grants, matched to local contributions, for the implementation of projects and involve local groups in the implementation process. There could be two categories of groups: self-help groups representing landless people; and area groups representing farmers in the micro catchments. These groups could form an executive committee from among the people who would administer projects through various contributions (cash, in-kind contributions or labour). Such contributions would be made against total estimated costs of projects aimed at developing private and common lands. This approach could ensure sustainability of such projects implemented at the grass roots level.

6. Institutional development/conditionality (pre-conditions)

- Institutional development is the key for success of any project, which involves large numbers of people. It is advised to involve non-governmental organizations (NGOs) as facilitators at grassroots levels. NGOs could be best equipped for social mobilization and capacity building activities.

- There should be a coordinated mechanism to ensure the collection of, access to and distribution at all levels (i.e. local to national) of appropriate information, building upon existing partner networks.
  - TIGER Initiative could provide an important framework for such a coordination mechanism at least for its initial phase due to TIGER's flexibility in information sharing.

- "Transparency" is a key to solving water resources management issues and "space-derived" information provides such "transparency" (no administrative boundary can be viewed from space).

- A possible approach could be to have an institution to manage information required at international level:
  - River basin authorities could be a model for such an institution.

- Efforts should be made to aim at confidence-building through shared information management.

- The information to be managed should encompass policy, social and technical aspects, at the initial point. Information to be shared internationally should be of general nature.

- There is a need to determine the recipients of information (both internal and external to the project).

- Project output should contain recommendations on policy issues related to utilizing space technology.

India's (ISRO) experience:

- A Management Information System (MIS) for internal use should be developed and a web-based module should be hosted on a website in the public domain so that the relevant information could be shared internationally (see, http://kar.nic.in/watershed/sujala/). Such packages have been developed by ISRO and are being used in the World Bank assisted Karnataka Watershed Development Project.

- A study should be conducted on environmental and social impacts of projects. The study should be carried out by an outside agency before the implementation projects.

- There should be procedures to be followed upon the completion of projects. NGOs, project implementation teams from local or national governments and other stakeholders should smoothly withdraw from projects insuring their sustainability. The resources used and created by projects should be, preferably, transferred to local communities. To insure successful withdrawal and sustainability of projects, local capacities should be sufficiently built.

- When developing a project, it is important to properly budget operations and maintenance costs to ensure the smooth transfer of the project to local authorities/communities. It is important to ensure that the right group of people are involved in the project.

7. Infrastructures, technical facilities, equipment

- Validation and calibration of space-based data is essential in catering to wide varieties of satellite and sensor data for meeting specific project execution purposes.

- An in-situ measurement network is fundamental. These could include spectroradiometers, differential Global Positioning System (DGPS), mobile mapping units, etc. Also, consider using data products from multi-

dimensional data assimilation techniques to fill in where in-situ data are lacking.

- Use of existing ground facilities and receiving stations and their upgrading should be optimized.

- The entire processing chain needs to be considered for any upgrading, augmentation or replacement.

- Acquisition of hardware/software, equipment and their maintenance has to be considered with respect to the project, its scope and requirements. Maintenance of hardware and application software is a crucial decision for the success of the project. This has to be clearly addressed at the inception.

- Considerations should be given to a proper trade-off between built-in, customized processing systems and commercially available systems having in mind the goal of sustainable operations (maintenance cost for commercial system should be taken into account). Today there are many tools, which could be used through certain simple developments using Open Source development environment. This could be explored for such projects based on the experience of the Indian Space Research Organisation (ISRO), which develops such tools for the World Bank project.

- Maintenance of equipment is a critical issue; development of local capability in this context should be emphasized.

- Local environmental conditions should be considered by manufacturers.

- Data summaries from existing hydro-meteorological networks should be required.

- Today there is affordable technology for operating Automatic Weather Stations (AWS) through satellite linkages for data collection and download. This should be one of the technologies to be introduced in such projects from the beginning.

- The following supporting data are important:
  - Base Maps (topographic, land use, hydrology, channel cross sections, etc.)
  - Digital elevation models (high resolution DEM)
  - Derivation of slope and aspect database from DEM
  - Watershed documentation and maps (highlighting ridge to valley)
  - Soil and its association characteristics
  - Land use studies using multitemporal satellite data
  - Hydro-geological and hydrological data and information
  - Geomorphology and structural maps of the terrain
  - Diversions and impoundments

- Water use at various points in a basin
- Simulation models, particularly with reference to disaster to be addressed

- Flood and drought forecasting methods need to be developed.

- Approaches to land use management need to be developed. This would amount to processing the satellite data by using multi-season data in a year as the base and designing the monitoring and management practice on a temporal basis. A detailed methodology document on this aspect could be prepared and provided as ISRO has executed such projects earlier.

8. Functional scope

- The minimum level of technical functionality (processing, measurement and evaluation) among all participants of the projects (e.g. all participating institutions) should be guaranteed. This should be ensured through proper design of the project. The design should clearly address the organizational structure at all levels. Roles and responsibilities to be clearly brought out amongst all stakeholders/institutions involved in the implementation of the project.

- The project should be implemented at basin level. This would be useful to generate a technically sound action plan for water resource development in the region through an integrated approach.

- Different information levels for decision makers should be addressed. This could be efficiently done by implementing the right kind of Management Information System (MIS)/GIS solution through customized software solutions. A client-server approach need to be adapted over a LAN/WAN kind of network for smooth information flow at all levels. Particularly, this is very important for the decision maker and project directorate on a day-to-day basis.

- A "bottom-up" approach should be pursued, ensuring the participation of all stakeholders at local level. This is possible by involving the communities in capacity building, planning, implementation and monitoring processes.

9. Capacity-building

- Capacity-building is essential to ensure the sustainability and autonomy.

- It is necessary to conduct a survey on what kind of education, training and capacity-building is required for which type of audience (e.g. decision makers, programme managers, technicians, local communities (e.g. farmers associations), women and young generation, etc.).

- Some areas of capacity-building include:

- social mobilisation and simple book keeping
- environment and technical training
- preparation of communities for participatory approach
- equipment management and maintenance
- data collection and analysis
- infrastructure management
- increasing awareness of decision makers

- Training for trainers is important.

- Institutional capacity-building is important (versus individual capacity-building).

- There is a need for capacity-building of river basin authorities on modeling and remote sensing.

- Promotion and strengthening of partner network is important.

10. Resources

- Proper budgeting is a key for the success of the project and should cover all elements such as cost of procurement of space data and equipment, training and capacity building, identification of key project professionals, participation of NGOs at grass root level, baseline survey of the area, identification of beneficiaries, social mobilization. Cost sharing at project and community levels as well as operations and management costs should be taken into consideration.

- Contributions from donor organizations, such as development agencies, regional commissions, regional development banks, and private sector, are essential. It is important that local authorities/communities provide grants matching the contributions of donors. This will ensure the sustainability of projects at local levels.

- Counterpart contribution and commitment are pillars for project sustainability. A degree of local contribution would be beneficial to ensure long-term commitment to the project.

11. Criteria for study area selection

- Transboundary basins should be given priority.

- Basin authority should exist.

- Well-documented needs assessment should be available.

- *In-situ* measurement network should exist. (Please note that such networks may be not too comprehensive and may lack automatic recording or reporting instruments.)

- Capacity in space technologies should exist.

- Non-governmental organizations should exist.

- Socio-economic and environmental impact should be considered.

- Existing related initiatives should be considered.

- Review of water laws, ecosystem protection, water quality criteria, etc., should be undertaken.

- Existing bi-lateral trans-boundary water and emergency cooperation agreements should be considered.

12. Water Resources Assessment

- Identification of key watershed and the major water resources problems and issues within each watershed in the basin should be technically assessed. This will cover socio-economic advantages of taking up such a project, number of people to benefit from the project, as well as total area to be covered and type of natural resources to be assessed. Natural resources budgeting needs to be done as a pre-cursor to the project.

- Assessment of the relative contributions of surface water and groundwater to the seasonal and drought-induced variations in total water resources and water use requirements. This will be a part of the baseline study, which will establish all such facts before the study is taken up.

- Hazard and risk assessment related to flooding and droughts.

- Assessment of existing emergency management practices

- Assessment of flood and drought mitigation options

13. Sharing the experience and outreach (increasing awareness of the general public)

- Each project should aim at increasing awareness of the general public and policy makers on importance of water resources management and usefulness of space-derived data and information for decision-making including by stimulating the awareness of the media and the press.