



**UNITED NATIONS/ISLAMIC REPUBLIC OF IRAN WORKSHOP ON
THE SPACE TECHNOLOGY APPLICATIONS FOR DROUGHT, FLOOD AND WATER RESOURCES MANAGEMENT,
TEHRAN, IRAN,
9-11 AUGUST 2021.**



IMPROVING THE WATER SECTOR THROUGH SPACE TECHNOLOGY FOR WATER RESOURCE MANAGEMENT

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INTRODUCTION

- ❑ **Water** is a common good and a limited resource that needs to be protected and used in a sustainable way as it's critical to all aspects of our lives now and in the future.
- ❑ **Water Sector** involves all the economic, political, social and environmental systems that consumes or uses water or have a say in its management or influence its abundance. Water is **under pressure from a variety of areas**, making water sector critical to:
 - Water supply and sanitation
 - Hydropower
 - Agriculture and food-security
 - Industrial production
 - Health
 - Sub-urban development
 - Climate-change (increase in the frequency of flooding and droughts)
- ❑ Therefore, **water resource management plan is important**. **Water resource management** is the activity of planning, developing, distributing and managing the optimum use of water resources under defined water policies and regulations.
- ❑ Inappropriate water management can deplete water sources, pollute water systems, contribute to soil infertility and erosion, and destroy natural ecosystems.
- ❑ An **important challenge** confronting water management is to improve water use efficiency and its sustainability; and this will be met by **how to utilize the timely, objective and accurate information**.



STATUS/CHALLENGES OF THE WATER SECTORS IN THE DEVELOPING NATIONS

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Some of the challenges to the water sector in developing nations are:

- ☐ How to supply and utilize water in the nation to meet acceptable quality and standards.
- ☐ How to establish the means to acquire, collate, manage and disseminate hydrological, hydro-meteorological and hydro-geological information for each of the river basins.
- ☐ How to ensure easy accessibility of supply of water to all citizens, including the poor and the most rural.
- ☐ How to reduce the pollution of surface and groundwater due to human and industrial waste.
- ☐ How to ascertain the nature and level of investment required in the sector.
- ☐ Power generation potentials of dams across the nation for better improvement.
- ☐ Challenges of health role of water.

Emerging Challenges:

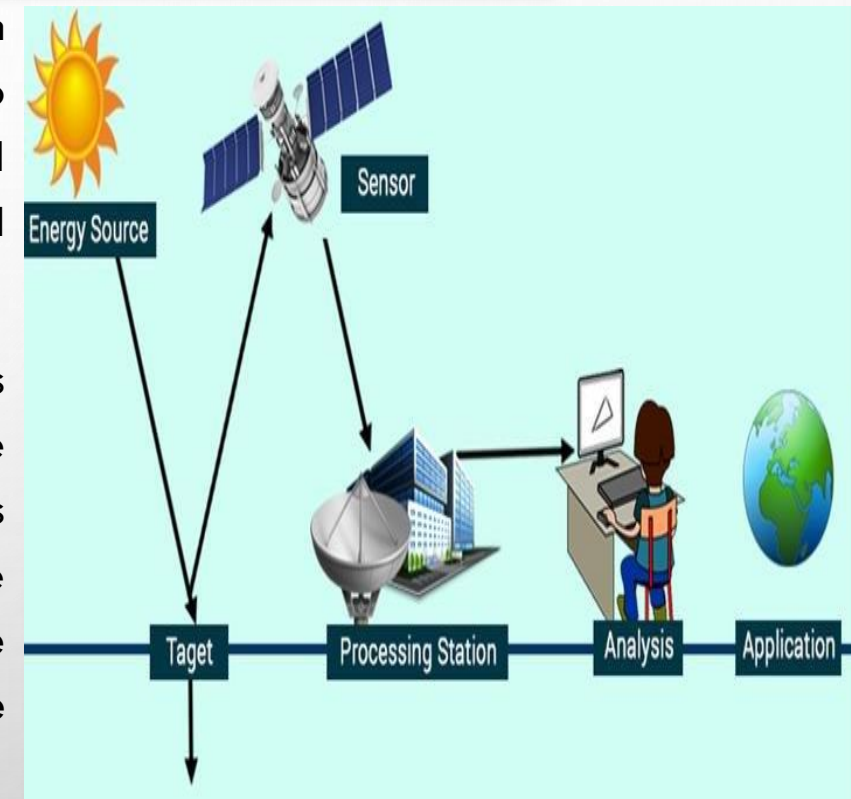
- ☐ Growth in population
- ☐ Urbanization
- ☐ Funding gaps
- ☐ Operations and Maintenance
- ☐ Policy Inconsistency





THE APPLICATION OF SPACE BASED TECHNOLOGY TO THE WATER SECTOR FOR WATER MANAGEMENT

- ❑ Space technologies are **developed by space science or the aerospace industry** for use in spaceflight, satellite, or space exploration. Space-based technology makes it possible to view from far above **water trends** of a nation/region addressing challenges on a **global scale**. Geographic Information System (**GIS**) and **Remote sensing** are space-based technologies.
- ❑ The **Earth Observation satellite** called **Remote Sensing Satellites** carries sensors/cameras payloads for imaging the Earth surface thus providing information on our environment, like vegetation, soil type, flood, forest, fire etc. The sensors collect data in the form of images and provide specialized capabilities for manipulating, analyzing, and visualizing those images. Remote sensed imagery is integrated within a GIS. **GIS are able to bring large amounts of data of both the physical and the social system together in one comprehensive overview shown digitally.**
- ❑ GPS (Global Positioning System) uses satellites that orbit Earth to send information to GPS receivers that are on the ground. The information helps determine location, while GIS is a software program (computer program) that helps to use the information that is collected from the GPS satellites.
- ❑ **Remote sensing is highly useful in the water sector for water resource management.**



BENEFITS OF SPACE TECHNOLOGIES FOR WATER MANAGEMENT ⁵



- ❑ Utilization of the **space-based data and technologies** can address water protection, water use and water management related issues, **facilitating improved monitoring and reporting** in relation to sustainable development. e.g. to establish an optimum hydrological network and collect baseline data and information on the river basins in order to aid better decision making regarding the abstraction, storage, flows and associated risks in the management of the river basins.
- ❑ Space technologies can address current issues and challenges related to **water management domain**, **identify gaps** and can contribute to better management of water resources in general.
- ❑ Space technology researches can be done on specific issues such as **mountain region-specific water challenges, combating desertification, water storage, floods and drought monitoring, ensuring access to safe drinking water and managing water-related emergencies**.
- ❑ To **improve the operations, maintenance and safety of dams and irrigation**. Harnessing the power generation potentials of dams for better improvement; and organizing the irrigation system so that participatory irrigation management can be practiced.
- ❑ To **help in the operations methodically and efficiently in a manner that will achieve sustainability and good governance**.
- ❑ Promotion of programming and development of **new software and models in space technologies** (e.g. modelling for flood management) for water resources management.
- ❑ **Prevention of disasters such as flooding on the farmland** by using space technologies to **view where there is a need to open-up water ways** by government and early warning about water disasters by communicating information to the end users (such as farmers).
- ❑ Water management and quality, for example by **researching on microplastics in water bodies**; effect of microplastics on zooplanktons, and humans at the end of the food chain; and the effects of microplastics on climate.



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GIS and Remote Sensing for Water Sectors in Developing Nations

Applications of GIS and Remote Sensing in Water
Sectors of Developing Nations for Sustainable
Development

GIS AND REMOTE SENSING: IMPORTANT TOOLS FOR WATER SECTOR



- ☐ Remote sensing is **surveying from space**.
- ☐ But presently, remote sensing remains essentially a **research tool rarely applied in water management systems/aspects of allocating water in river-basin systems in the developing countries**.
- ☐ Remote sensing is **not a specialized-research tool**, but **an important asset for water resources management**.
- ☐ Remote sensing software is **becoming more user-friendly**, and **accessible to more people of various disciplines**.
- ☐ Remote sensing algorithms are now **more-sufficiently understandable**, from a technical-point-of-view with the **knowledge transferrable to water resources managers**.
- ☐ **Developing-nations** are quite **often unaware of the new technical possibilities on GIS and remote sensing**, partly because the **discussions/images on remote sensing remains within the remote sensing community (Space-Agencies/Organizations)**, making the **data to remain under-utilized by practicing water-resource managers**.

IMPORTANCE OF WATER PROFESSIONALS OR WATER MANAGEMENT EXPERTS

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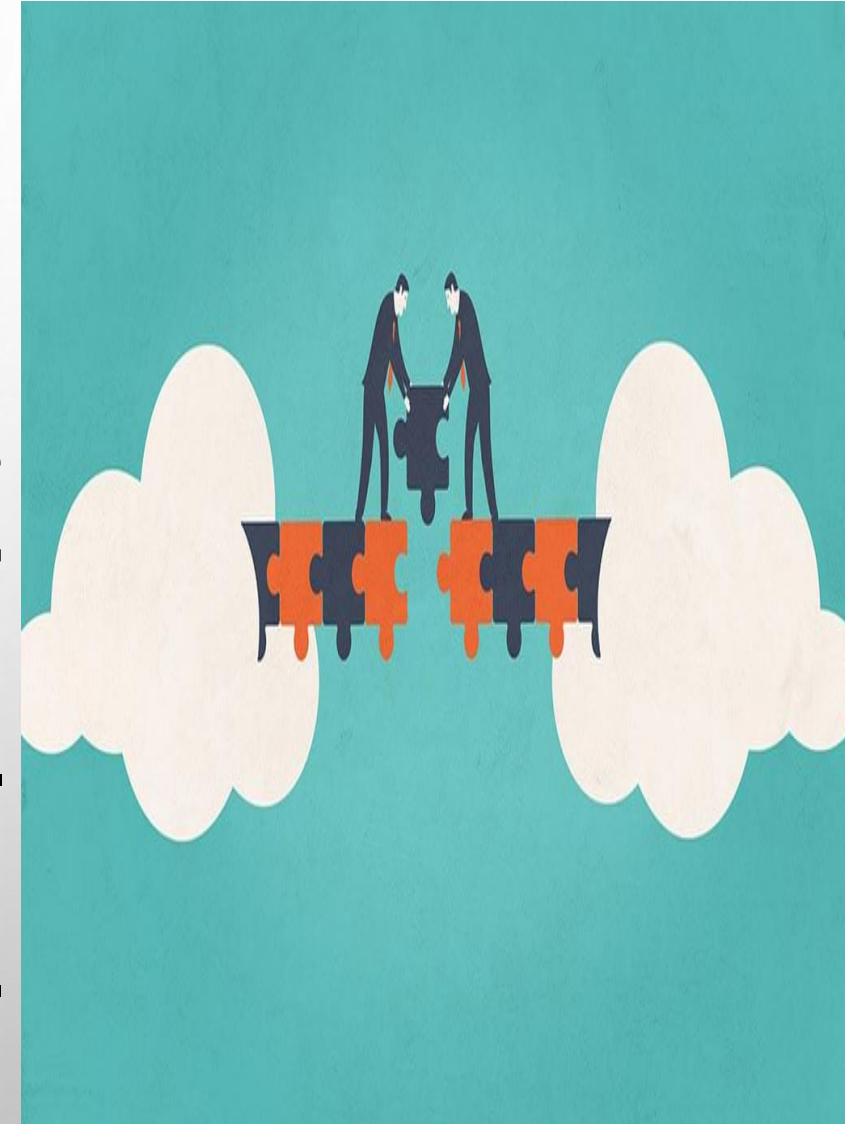


- ❑ **National water management is not likely to work without water professionals or water management experts.**
- ❑ **Water professionals are problem-oriented researchers in the knowledge of water quality, management and protection (**water security**).**
- ❑ **Many of the developing nations lack competent water professionals, therefore the need to train them has arisen due to the several challenges in the water sector.**
- ❑ **Competent water professionals in the water sector are highly important.**



COLLABORATION OF ORGANIZATIONS RESEARCHING IN RELATION TO WATER AND SPACE

- ❑ **Bridging the researchers–practitioners gap is cogent.**
- ❑ **The collaboration of organizations researching in relation to water and space will allow the management of water resources by sharing data from research-done and bringing about demonstration-projects.**
- ❑ **Training on modelling for flood-management is also important.**



SDG GOAL 4 – QUALITY EDUCATION AND GOAL 6 – CLEAN WATER AND SANITATION OF THE UNITED NATIONS ARE EFFECTIVE IN ACHIEVING WATER MANAGEMENT



- ❖ The Goal 6 – “Clean Water and Sanitation” of the SDGs is **to ensure availability and sustainable management of water and sanitation for all**.
- ❖ Summarily, goal 6 is for **sustainable water management (SWM)**. SWM is a critical component of sustainable development, and accounts for similar issues as sustainability. SWM is meeting current water demand for all water users **without impairing future supply**.
- ❖ **Safe and affordable drinking water for all by 2030** requires **adequate investment in infrastructure**, the need to **provide sanitation facilities**, and to **encourage hygiene**; therefore allowing the **protection and restoration of water-related ecosystems**.
- ❖ These all cannot be achieved without **educating people (Goal 4)** on this matter to be aware of the reasons why they should manage and drink safe water, and why they need to do proper and adequate sanitation.
- ❖ It is now evident that **without been skilled and educated on water matters, there cannot be practical achievement in water management and protection**. The world at large is going through tough periods on water management and protection because **only few people are educated in this line**.
- ❖ **More competent water professionals are needed.**



The Sustainable Development Goals (SDGs)



CONCLUSION

- ❖ The **applications and benefits of GIS and Remote Sensing extend far beyond Space**. They are important assets for water resources management.
- ❖ **Current water professionals and water management experts** can have **capacity building** to aid their work and career in relation to space-based technology to enhance water management.
- ❖ There should be **collaborations amongst water and space organizations to enhance water management efficiencies** in the water sector.
- ❖ In all, if **GIS and Remote Sensing are critically applied** in the water sectors of the developing nations especially, it will target the **three pillars of sustainability: economic development, environmental protection and social equity**.



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