# Priorities and Actions for Sustainable Agriculture Water Management in MENA Region

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# Overview

- …Why is sustainable Agriculture Water Management (AWM) important for MENA countries?
- Priorities actions for AWM
    - Water and Food Security (relevance, status, priorities)

      - Water Saving Technologies

      - System modernisation
    - Water and Environnent (relevance, status, priorities)

      - Water Quality and Reuse

      - Water desalination (promising ideas)
- Conclusion & Recommendations

# Why is sustainable agriculture water management important for MENA countries?

- **Water scarcity/ declining food security** : The region relies heavily on imports of food and cannot become self-sufficient due to the lack of water for irrigation

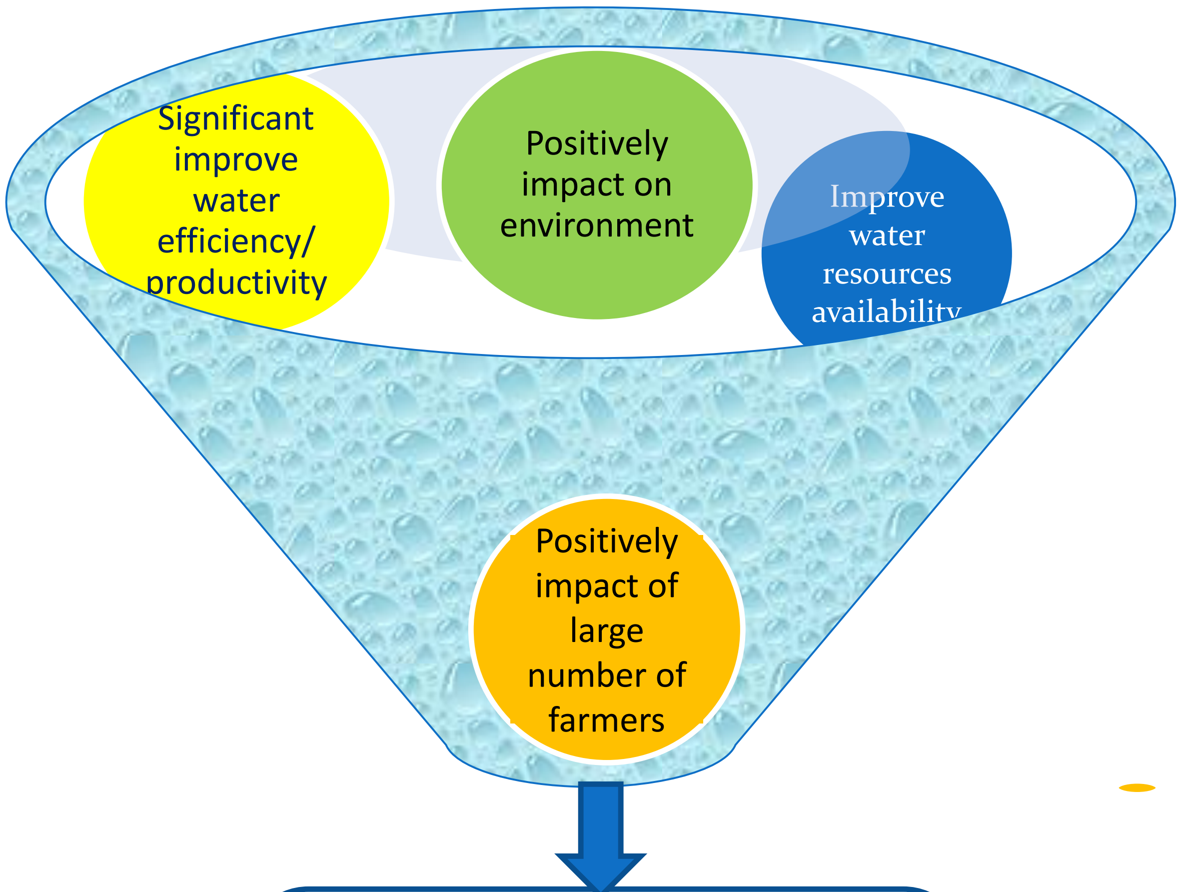
- **High vulnerability of Agriculture,** food systems and livelihoods to climate change/variability

- Agriculture and agro-processing **account for 10-20% of GDP** in North Africa, and an even larger share of employment

- Most of rural population **(1/3 of total population depend significantly on agriculture)** and generally settled on the most fragile land with meager and/or highly variable WR

# Priorities actions for AWM

**CRITERIA**




**ACTIONS**

1. Technically feasible
2. Economically affordable
3. Socially acceptable
4. Environmentally sustainable

# Water Management
# &
# Food Security

# Water and Food Security: Relevance

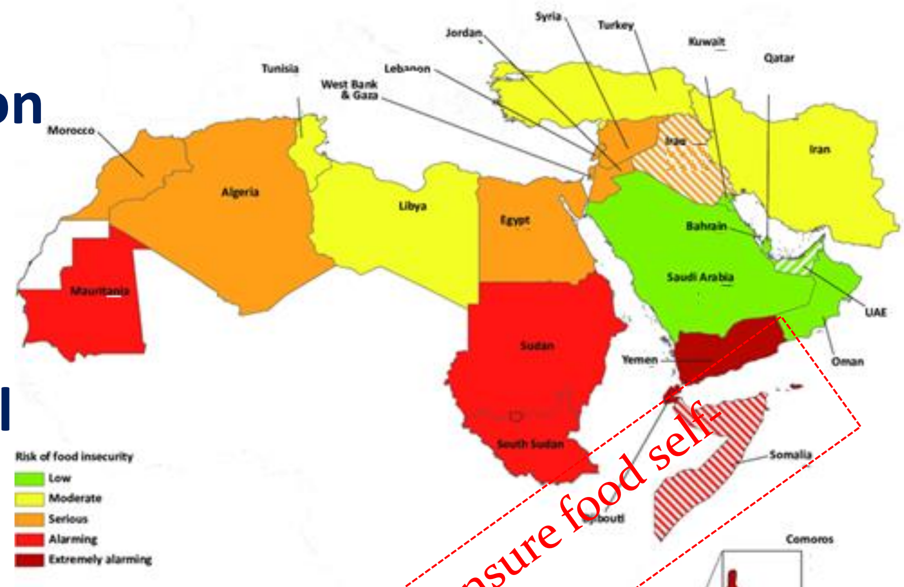
**Fast rising demand versus limited** and increasingly **variable w**ater resources

**Low crop productivity to provide more food (low irrigation efficiency)**

**high vulnerability to extreme situations (floods, droughts)**

# Water and Food Security: Status

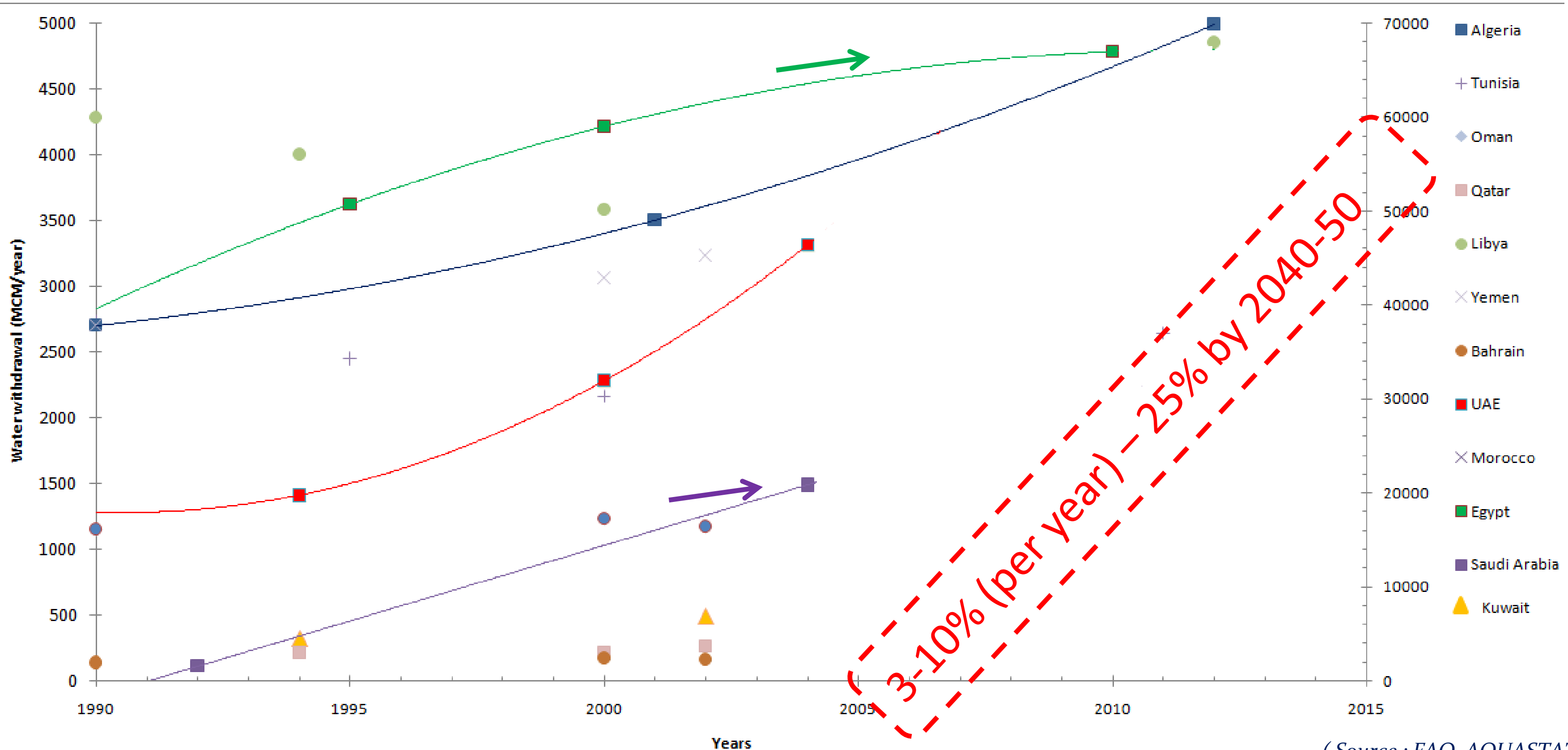
1. MENA is the **most food import–dependent** region in the world (net food imports accounted for 25 to 50% of National Consumption
2. **Limited potential for land expansion** with increasing competition from other sectors
3. Farm yields of crops in the MENA region **are far below their potential** (Wheat in rain fed 0.8 to 2.0 t/ha)
4. **Limited exchange of knowledge** between sci, admin, commercial sectors, end-users
5. **Increasing urbanization** (3.3% year) affecting the volume and WQ available for agriculture




Risk of food insecurity in the Middle East and North Africa. (*Source:* Breisinger et al. 2012)

High priorities to ensure food self-sufficiency

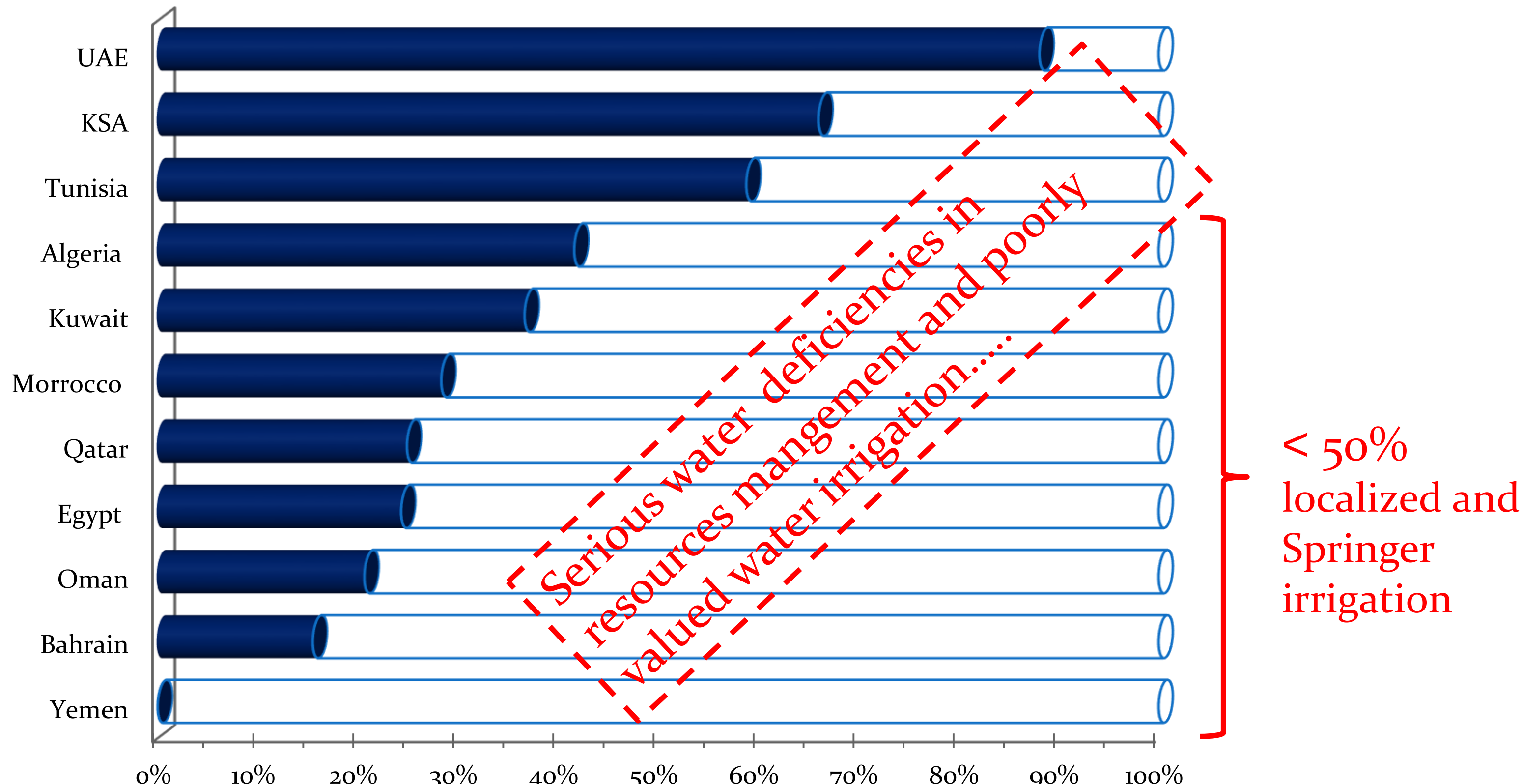
# Trends in Agriculture water withdrawal (1990-2012)



( Source : FAO, AQUASTAT,2016)

This scenario represents **a threat to the long-term role** of irrigated agriculture in global food security, which cannot meet current or future demands for irrigation

# Water Saving Technologies: Economic irrigation techniques




*( Source : FAO, AQUASTAT,2016)*

-Increasing the efficiency of irrigation infrastructure and water supply networks

-Development and adoption of new economical irrigation techniques

# Water and Food Security: Recommendations & Priorities actions


**Improving irrigation efficiency**

**Supplemental irrigation** /deficit (rain fed areas) . Water harvesting (rangeland areas)

**Cultural practices and development such as** conservation tillage, planting densities, and improved varieties

**Water scarcity and energy concerns for agriculture purposes have risen,**
**Research and development of irrigation methods has increased ….**

# Factors to consider when choosing an irrigation system

**Crop Types**

**Energy:** Cost, availability, consumption

**Initial cost**

**Labor requirement**

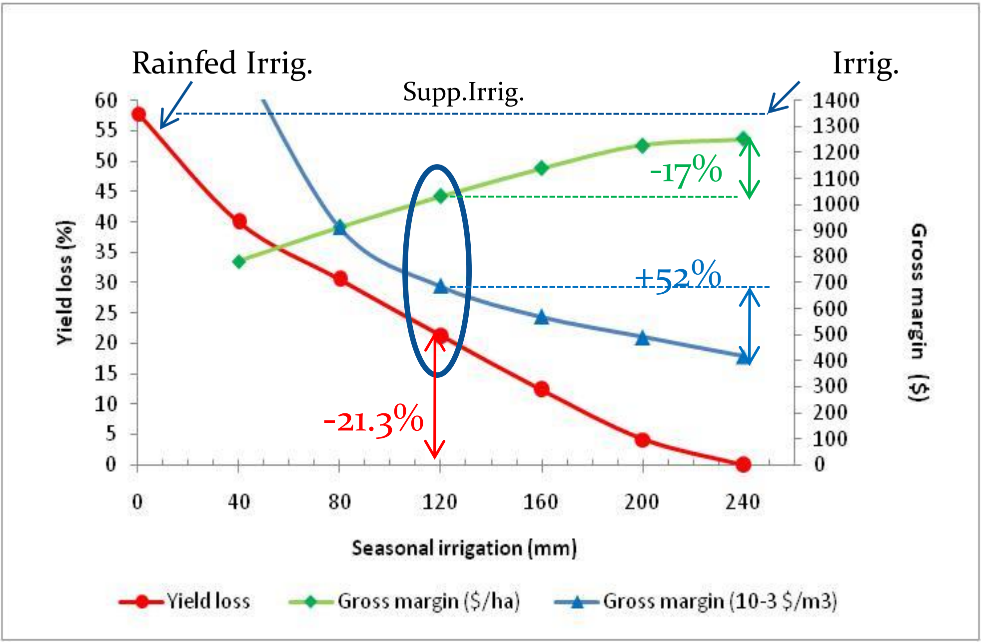
**Size and Shape of field:** Area, geometric shape, topography, slope

**Soil**: Physical and chemical characteristics, heterogeneity

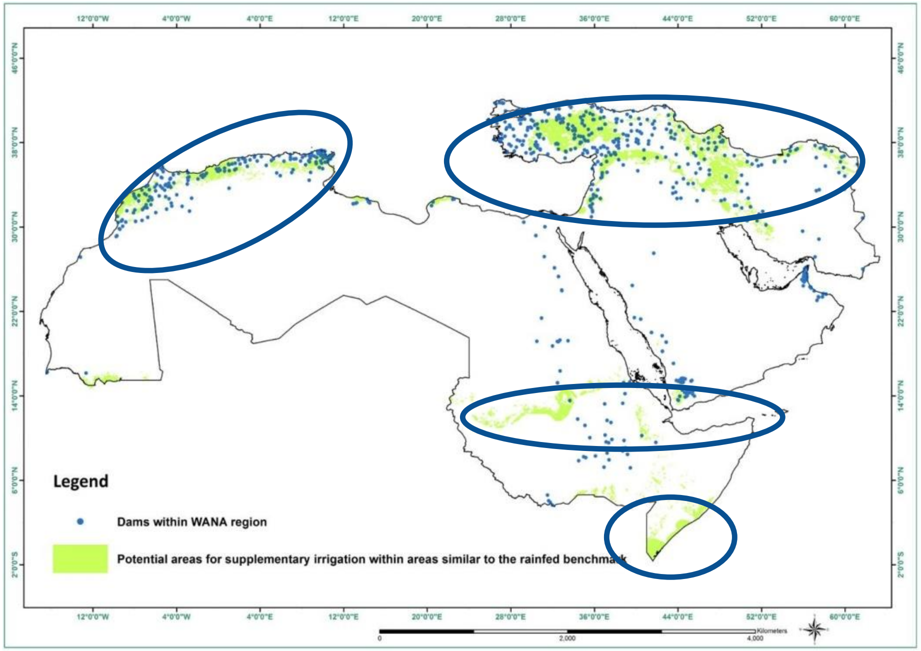
**Water sources**: Flow rate, quality

**Weather**: Wind speed, Temperature

# Water Saving Technologies: Supplementary Irrigation (Tunisia)




Economic analysis of the wheat crop responses to deficit Springer irrigation : Source: Zairi et al (2003)




Closest water resources to potential sites for supplementary irrigation within areas similar to the rained benchmark (*Source: F. Ziadat et al. (2014) ICARDA*

- ✓58% gain of supplementary Irrig/ Full Irrig
- ✓ 50% reduction in seasonal irrigation lead to:
  - **- 21,3% relative yield loss**
  - **- 17% reduction in GM/ha**
  - **- 52% increase in GM/m3**

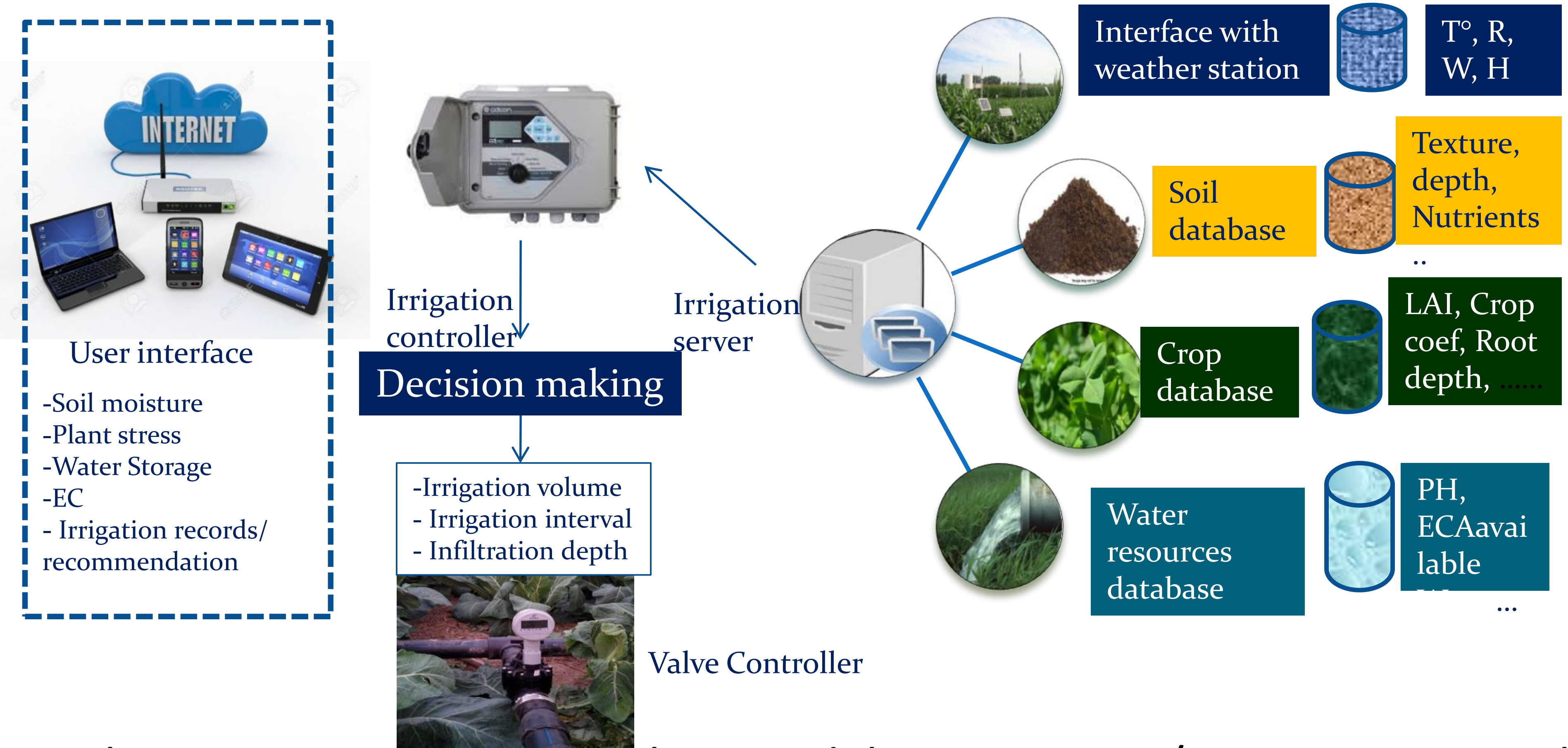
# Water and Food Security: Recommendations & Priorities actions


**Remote sensing techniques** for data provision, up scaling, forecast and analysis)

**Precision farming** and nutrient management

**Increasing the value** and viability of agriculture

# System Modernisation: Smart water saving Irrig




Further improvement to the model parameters/irrigation control strategy for different cultivation in various Irrigation Mgt, Env., and Climatic conditions

# Water and Environnent

# Water and Environment: Relevance

Water security and Food production **depend largely on healthy ecosystems**

Urbanization, industrialization, intensification in agriculture lead to severe **impacts** on **water quality** (and in turn on **ecosystems** and **population** (health)

**Pollution from waste water** (and solid waste) systems (leakage, increasing traffic, mining) and from desalination plants)

# Water and Environnent: Status

- ➢ **25% of Tot WW is "treated and unused"**
- ➢**18% are treated and reused**
- ➢**57% is untreated:** Risks aggravated by agricultural practices


- ➢**Insufficient WQ monitoring systems** for monitoring/design/operation

- ➢**Deficits in understanding** the linkage between WQ status/environmental and health impacts

- ➢**Seawater intrusion in coastal aquifers** (sea level rise; increasing withdrawals)

# Water and Environement: Recommendations & Priorities actions


Establishing reliable **baseline data**/ inventories for water and soil contamination from agricultural runoff

Developing **effective methods** to control agricultural pollutants /modeling the effects of contaminants on biota and pathways of microbial contaminants

**Assessment of reuse** in the context of aquifer recharge especially for the emerging pollutants

# Water and Environment: Recommendations & Priorities actions

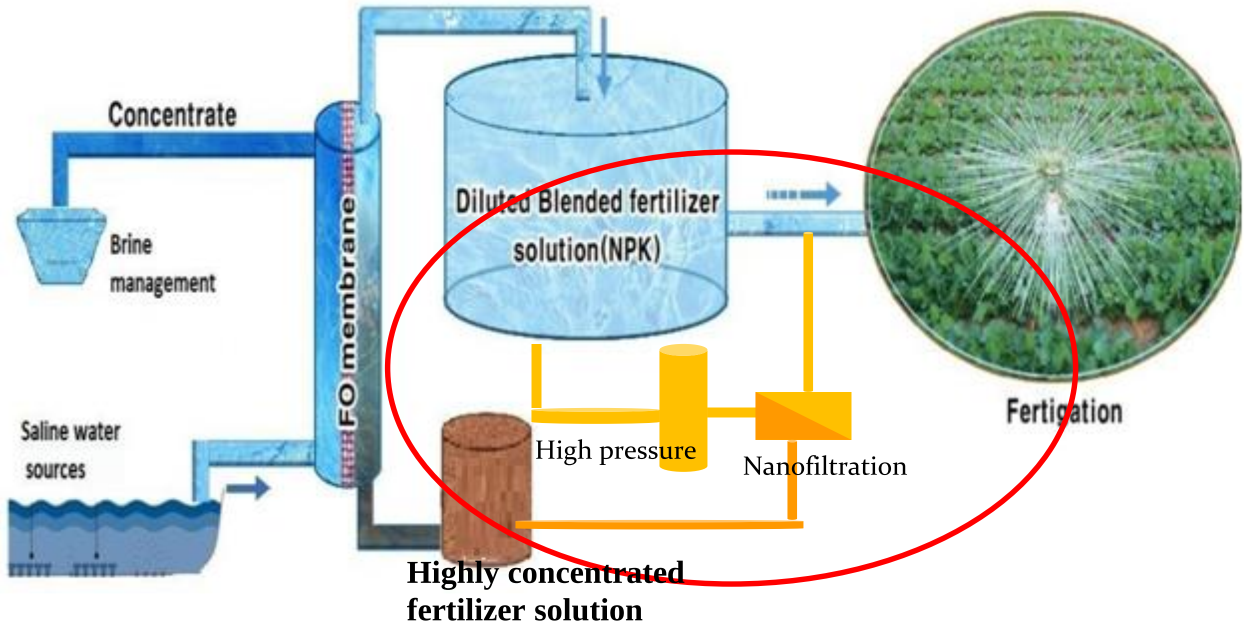

**Growing need of desalination** . The assessment of the socioeconomic impact of agricultural DW use for policy makers

**To monitor the quality of DW produced at DPs** for assessing its agronomic suitability based on the quality standards for crop and soil Protection

**Brine disposal and Emission of harmful oxides from burning fossil fuels:**

- To find cheaper and environmentally friendly method of brine reject (Development of RE technologies)

# Agriculture Desalination Plant: Promising idea




A Novel membrane technology, based on Fertilizer Drawn Forward Osmosis (FDFO) application (Phuntsho et al. 2011)

FDFO requires **low energy** since it is based on the principle of **natural osmotic process** driven by concentration gradient and not hydraulic process (RO)

**Main challenge:**

-**Appropriate nutrient** concentration

-**Integrated NF** as post treat. for direct fertigation (lower energy consumption comparing to MF-RO and UF-RO by 14 and 20%

# Agriculture Desalination Plant: Promising ideas

~ 80 % condensation water recovery **but costly and** needs improvement for MENA countries **Use of desiccants for cooling and humidity removal**

Desiccant Greenhouse in Emirate Sharjah (UAE),

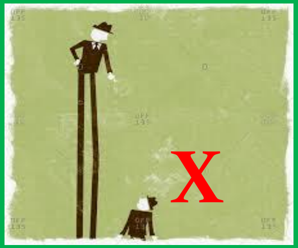
Desiccant driven closed greenhouses (Cairo Univ) allowing to yielding condensed water for irrigation

# Conclusions & Recommendations

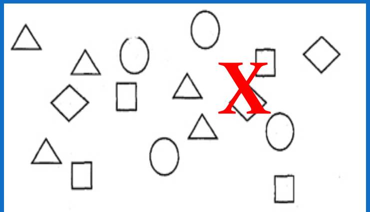
**Investing in innovative technologies for sustainable AWM**



**Improving and building common knowledge and practices for better water management**



**Participatory approach, involving users, planners and policymakers at all levels**




**Changing in the way of managing AWR from fragmented approach to an integrated one**


Thank You!