TechWorld 2024 & DigitalSustainability 2024

PANEL #1

Challenges in Environmental Sustainability

Panel #1

VALENCIA
FALL 2024

Moderator

Prof. Dr. Sandra Sendra, Universitat Politècnica de València, Spain

Panelists

Assist. Prof. Dr. Lorena Parra, Universidad Politécnica de Madrid, Spain

Dr. Mahmood Ahmad, RIZQ/YUNUS WEFnex Hub AIT, Thailand

Ph. D. Candidate Francisco Javier Diaz, Universitat Politècnica de València, Spain

Prof. Dr. Petre Dini. IARIA. USA/EU

Moderator Position

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Sandra Sendra

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

- **Definition 1: Climate change**
  - It refers to long-term shifts in temperatures and weather patterns.
  - While these changes can occur naturally, such as through variations in solar activity or volcanic eruptions, the term is most commonly used to describe the significant changes in climate patterns attributed to human activities since the 1800s.
  - Activities, particularly the burning of fossil fuels like coal, oil, and gas, increase levels of greenhouse gases in the atmosphere, trapping heat and raising Earth's average surface temperature

- **Definition 2: Environmental sustainability**
  - It refers to the responsibility to conserve natural resources and protect global ecosystems to support health and well-being, now and in the future.
  - It involves making decisions and taking actions that do not deplete resources or harm natural cycles, ensuring that future generations can meet their needs as well

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- **Innovative Solutions and Sustainable Practices**
  - **Renewable Energy Technologies:** Investing in solar, wind, and other renewable energy sources to reduce reliance on fossil fuels.
  - **Circular Economy Models:** Adopting circular economy principles to design products for reuse, recycling, and minimal waste.
  - **Digital Platforms for Collaboration:** Leveraging online platforms to facilitate collaboration and innovation in sustainability efforts, reducing the need for travel and physical meetings.
  - **Consumer Culture:** High consumption patterns, especially in developed countries, drive resource depletion and waste generation, putting additional strain on the environment.
  - **Policy and Governance:** Inconsistent environmental policies and lack of enforcement hinder global efforts to address sustainability challenges effectively.

Challenges in Soil Sustainability (and Solutions)

Fco Javier Diaz
UNIVERSITAT POLITÈCNICA DE VALÈNCIA

- **Nutrient Depletion and Soil Degradation** → Overuse of chemical fertilizers, reduction in organic matter, erosion, compaction and fertility loss:
  - ↳ Implement contour farming and terracing to reduce erosion.
  - ↳ Use no-till farming to prevent compaction and maintain soil structure.
  - ↳ Promote crop rotation and cover cropping to restore nutrients.
  - ↳ Incorporate organic compost and biofertilizers to enrich soil naturally.
- **Soil Contamination** → Pollution from pesticides, industrial waste, and plastics:
  - ↳ Use phytoremediation (plants that absorb contaminants).
  - ↳ Encourage Integrated Pest Management (IPM) to reduce chemical use.
- **Urbanization and Land-Use Change** → Loss of fertile land and topsoil due to construction:
  - ↳ Enforce green zoning and protect arable land.
  - ↳ Develop vertical farming and urban agriculture to preserve soil.
- **Climate Change Impact** → Desertification and altered precipitation patterns:
  - ↳ Practice agroforestry to increase soil resilience and carbon capture.
  - ↳ Enhance soil water retention using biochar and mulching techniques.

Panelist Position

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Lorena Parra

UNIVERSIDAD POLITÉCNICA DE MADRID

- **Challenges in Water Sustainability**
  - **Worldwide Problems**
    - Limitation of available water
      - Increasing levels of pollution
      - Exacerbate by Climate Change (changes in precipitation patters and new arid or semiarid regions)
    - Inefficient water management
      - Infrastructure with losses
      - Agriculture activity consumes 70% of water. Outdated irrigation methods
    - *Transboundary Water Conflicts*
    - *Biodiversity loss*
  - **Global Framework beyond SDG-6**
    - ↳ Integrated Water Resources Management (IWRM)
    - ↳ European Water Framework Directive
    - ↳ Water Action Agenda

Panelist Position

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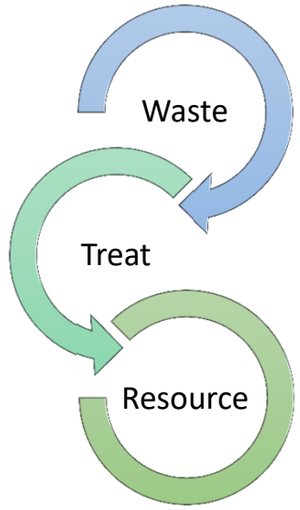
- **Challenges in Water Sustainability**
  - **Water Circular Economy**
    - Reducing Water Consumption
    - Recycling and Reuse
    - Regeneration of Ecosystems
    - Recover Energy and Resources



Lorena Parra

UNIVERSIDAD POLITÉCNICA DE MADRID

  - **Reclaimed Water as a Solution**
    - Water water have been used for multiple purposes:
      - Cleaning, *irrigation*, cooling systems of power plants, ponds and fountains, industrial processes, *wetlands restorations, groundwater recharge*, concrete mixing…
    - Use of rainwater harvesting
    - Sinergy with industry

    - Water Reuse Regulation
      - E. coli, BOD, TSS, Turbidity, Legionella spp., Intestinal nematodes (once a week)

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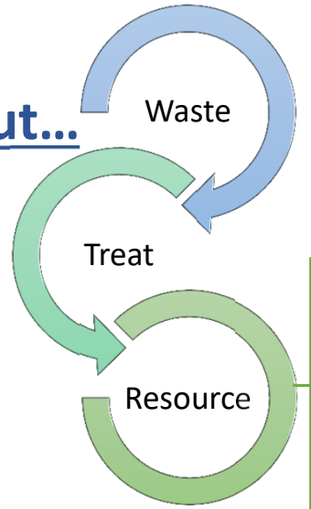
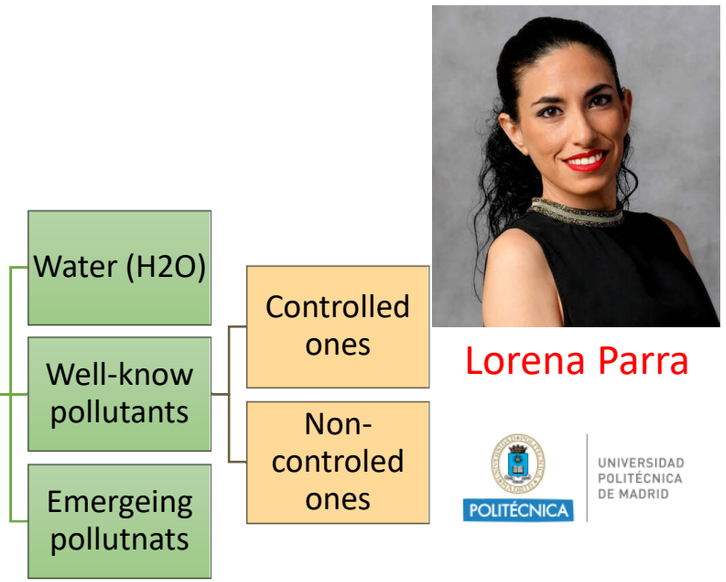
- **Challenges in Water Sustainability**
  - **Regenerated water seems to be a solution but…**





Lorena Parra

UNIVERSIDAD POLITÉCNICA DE MADRID

- **Found effects of irrigated lands:**

High salinity

Imbalanced Nutrient Content

Emerging pollutants

Microplastics

Medicines (antibiotics and hormones)

- **High cost for the required infrastructure**
- **Lack of public acceptance**
- **Existing regulation is not enough**
- **Few data about its use and long-term effects →** *Special management of irrigated areas*

Ambiguous and Unsure Future

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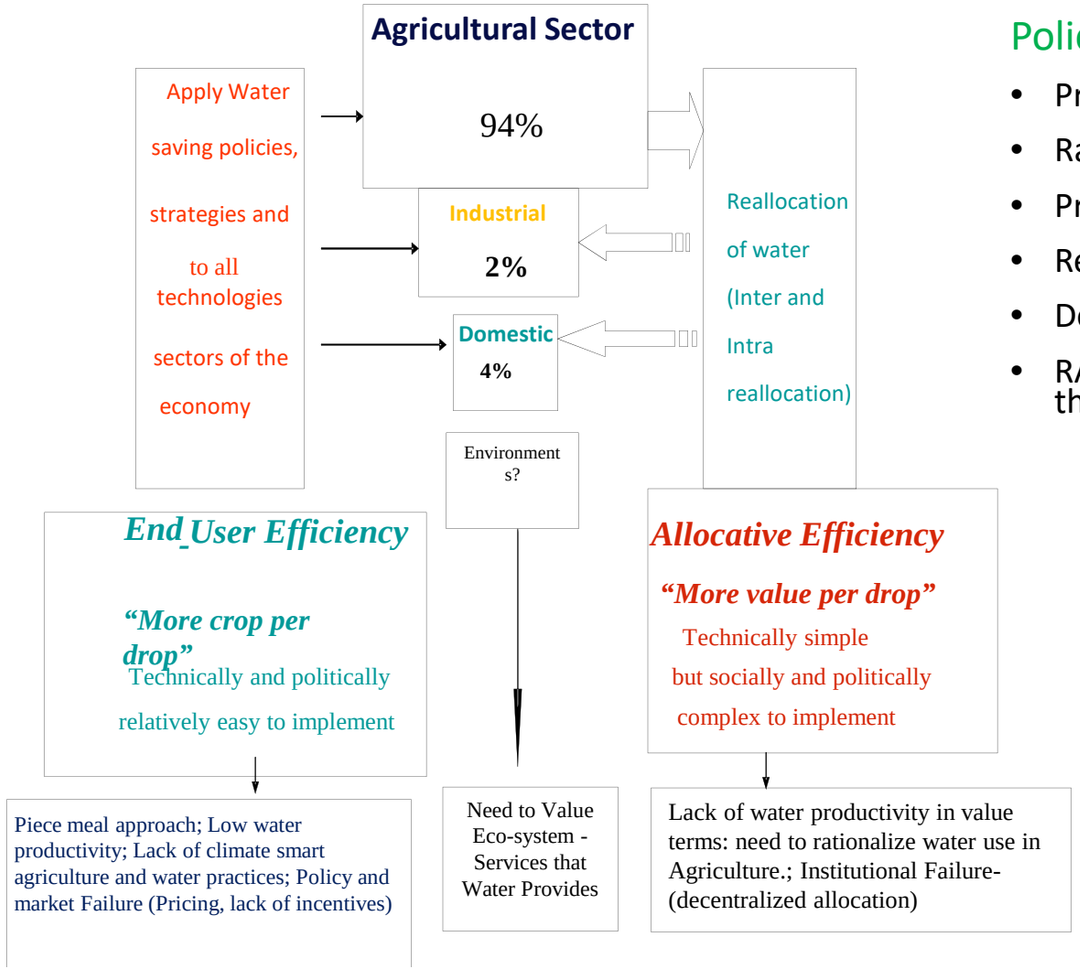
Water – Agri uses most, wastes large part, and produces least



Policy Options or Solutions

- Productive versus allocative efficiency
- Rationalize water use in agriculture
- Pricing the resource
- Recycle or circular economy
- Decentralize irrigation management
- RA technologies and practices also bring benefits than cost

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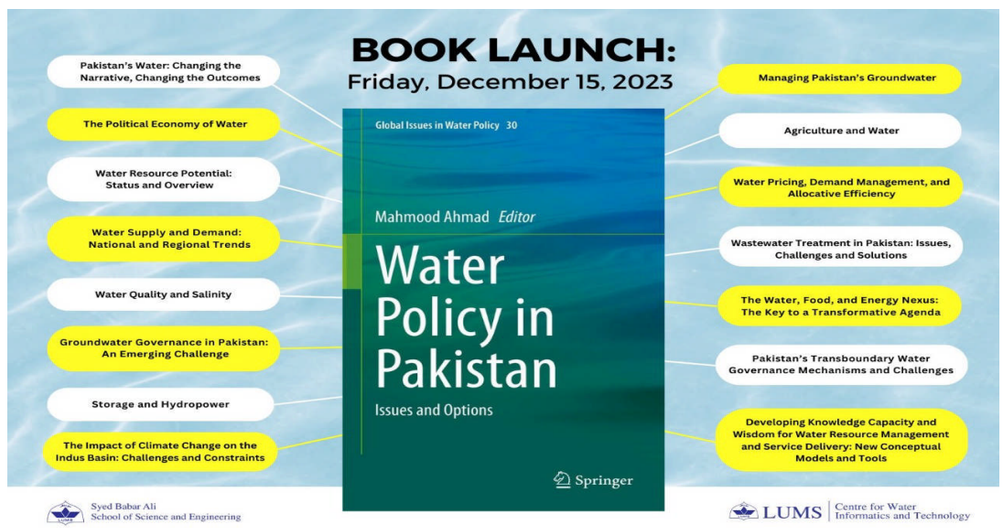

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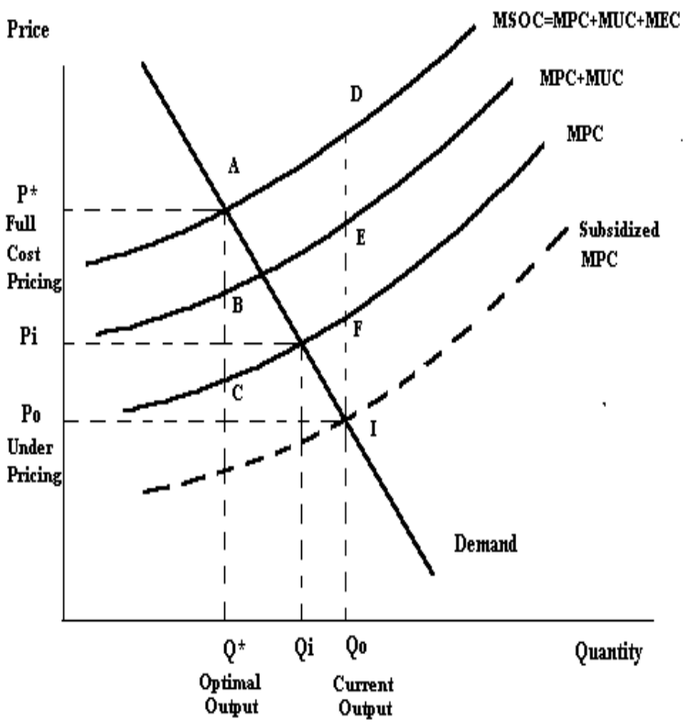
Energy – Challenges in Rapid Transformation to Renewable Energy

Policy, Institutional and Market failure



Challenges

- Misaligned demand, Inefficient tariff structure and poorly targeted subsidies, huge and growing circular debt
- Power theft, aging infrastructure , lack of innovations
- Information asymmetry, lack of competition

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Solutions

- developing sustainable energy policies, it has to delink its dependence on imported costly and unstable fossil fuel market,
- this cannot happen unless key policy reforms are put in place to reduce circular debt, long due policy reforms all along the supply chain with greater markets role
- to drive future investments in the energy sector and pave the ways to decarbonize and push for greener growth and let private led solar energy drive a success

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FAO Driven

Conservation Agriculture

Grow and Save (value chain approach)

Climate Smart Agriculture **(CGIAR)**

Global and Donors

Regenerative Agriculture

Eco Based Solutions

National Programs

Pedaver, Pakistan

Zero Budget Farming (India)

Rainforest Alliance (Latin America)

Rainforest Alliance (Global)

Evolving Concepts

Conservation Agriculture & Grow and Save

FAO Driven

Climate Smart Agriculture- Adaptation, Mitigation, and Productivity

Multi Agencies Driven

Regenerative Agriculture Integrating Livestock and Agroforestry

Global Driven

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Save Planet

Improve Agro-ecosystem

Improve soil health

Low water and energy-intensive use

Low carbon footprint

Practices & Technologies

No Tillage	Climate Resilient seed	Soil Amendment: Manure/ Compost/Biochar	Integrating Livestock
Mulching	Integrated Pest Management	Intercropping	Integrating Agroforestry

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Petre Dini
IARIA
USA/EU

Environmental sustainability is spanning various sectors and scales

Climate Change: **S**hifts in temperature, weather patterns, and sea levels; global warming

Biodiversity Loss: Decline in species across habitats; habitat destruction, pollution, climate change, overfishing, and invasive species

Deforestation and Land Degradation: Clearing of forests for agriculture, logging, and urbanism; CO2 emissions, decreased carbon absorption

Water Scarcity and Pollution: Demands for water resources; pollution from agricultural runoff, wastewater, and industrial processes; stress on freshwater systems and changes in water quality and availability

Pollution: Air, water, and soil pollution from industrial activities, transportation, and chemical usage; health; humans&wildlife

Resource Depletion: Unsustainable extraction and consumption of natural resources; needs exceed Earth's regenerative capacity

Energy Production and Consumption: Fossil fuel-based energy systems vs. renewable sources; challenges on scalability, storage, and distribution.

Waste Management: Solid and hazardous waste from urban areas and industries; reduction, recycling,.. ; contamination

Urbanization: habitat loss, increased pollution, and higher energy consumption; sustainable urban planning

Social and Economic Inequality: Disparities in wealth and resources; poorer communities cannot afford (see recent C offset)

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Waste Management

Petre Dini
IARIA
USA/EU

Municipal Waste: Household and commercial waste: collection, recycling, and disposal to prevent pollution, reduc greenhouse gas emissions, and maintain public health.

Industrial Waste: Manufacturing, chemicals, and mining; hazardous materials; environmental contamination; worl

Construction and Demolition: Waste materials, such as concrete, bricks, wood, and metal; recycling and reusing

Electronic Waste (E-Waste): Electronic waste is one of the fastest-growing waste streams; valuable materials; hazardous substances such as lead and mercury.

Healthcare Waste: This includes waste generated by hospitals and medical laboratories, such as syringes, bandages, and chemical wastes. Proper management is essential to prevent the spread of infections and protect public health.

Agricultural Waste: Quantities of organic waste, including crop residues and animal manure; composting and biogas production

Automotive Waste: **End-of-life vehicles and associated products - batteries and tires; recycling and disposal; hazardous materials and recyclable components.**

Plastics and Packaging: Packaging materials; reduce, reuse, and recycle to minimizing their environmental footprint.

Hazardous Waste: Sources - industrial, medical, and household activities-; requires special handling, treatment, and disposal techniques.

Food Waste: Major global issue globally; from production, retail, and consumption.

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Waste management for windmill propellers and electric car batteries

Petre Dini
IARIA
USA/EU

- **Windmill Propellers**

Material Composition: Windmill propellers, made from composite materials such as fiberglass or carbon fiber, which are difficult to recycle; resins and fibers used in these composites cannot be separate and reuse.

Size and Transport: Wind turbine blades are large and cumbersome; this complicates their transport to recycling centers or disposal sites; an increased the carbon footprint associated with their disposal.

Limited Recycling Options: Limited infrastructure for recycling composite materials used in turbine blades; ost end up in landfills because they are not biodegradable and are difficult to break down.

Volume of Waste: When wind turbines reach the end of their lifespan, the volume of waste they generate is expected to increase significantly; necessitates sustainable disposal solutions.

Development of Recycling Technologies: Initiatives are exploring ways to recycle turbine blades into new products - panels, construction materials-; not yet widely adopted.

- **Electric Car Batteries**

Toxicity and Pollution: EV batteries contain hazardous materials like lithium, cobalt, and nickel

Resource Scarcity: Raw materials used in EV batteries are scarce and sourced from geopolitically sensitive regions. materials expensive; ethical concerns regarding mining practices.

Recycling Processes: EV batteries can be recycled; the process is complex and energy-intensive.; disassembling the battery; safely handling the hazardous materials, processing these for reuse.

End-of-Life Management: Effective strategies are needed; e.g., second-life applications (such as energy storage systems) or recycling to recover valuable materials.

Economic Viability: Economic feasibility of recycling battery materials often depends on the recovery of high-value materials. If the costs of collection, transport, and processing exceed the value of the recovered materials, recycling, etc.

STAGE IS YOURS!