Opportunities to enhance water use efficiency in irrigated agriculture through innovative irrigation technologies

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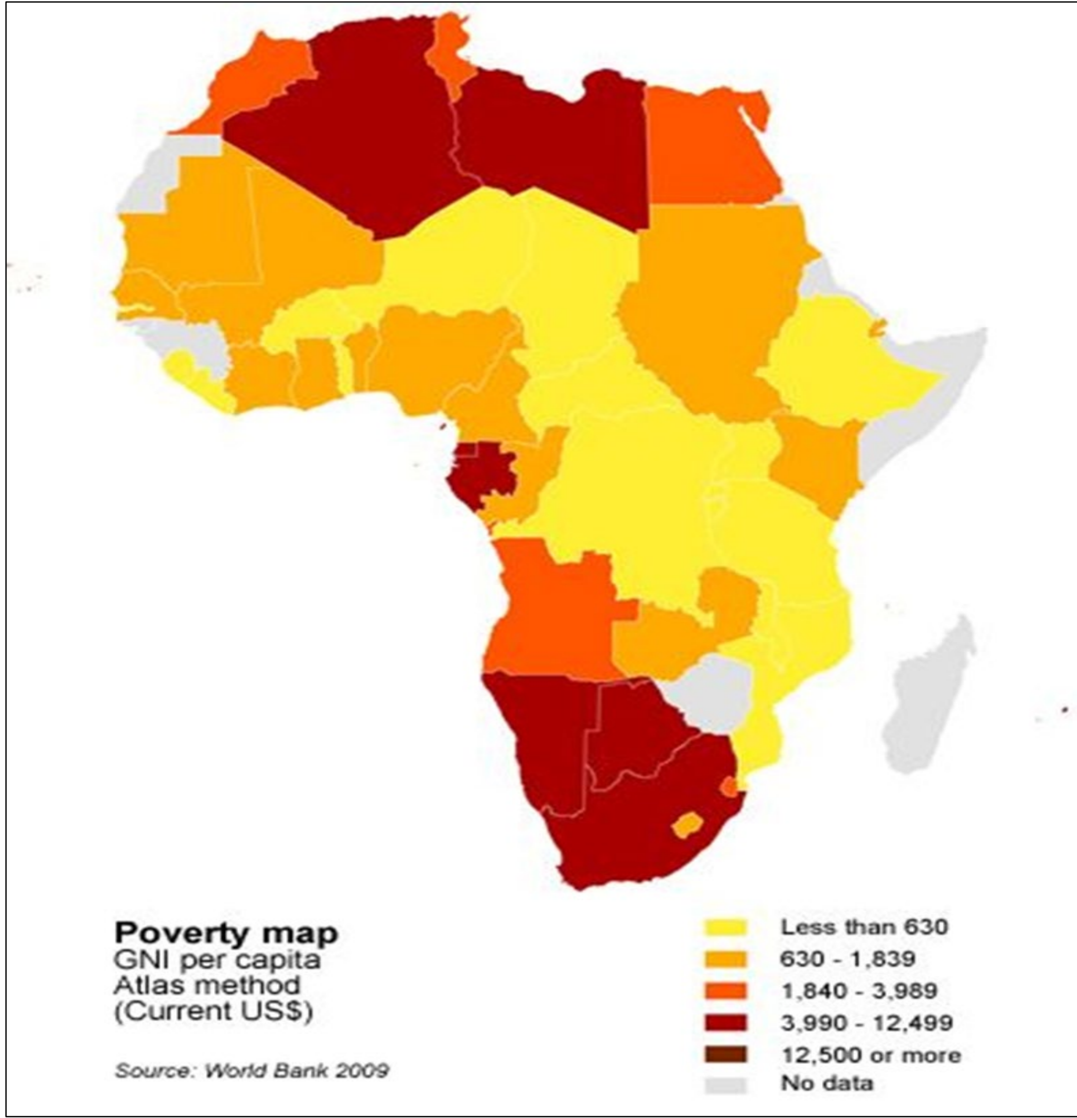
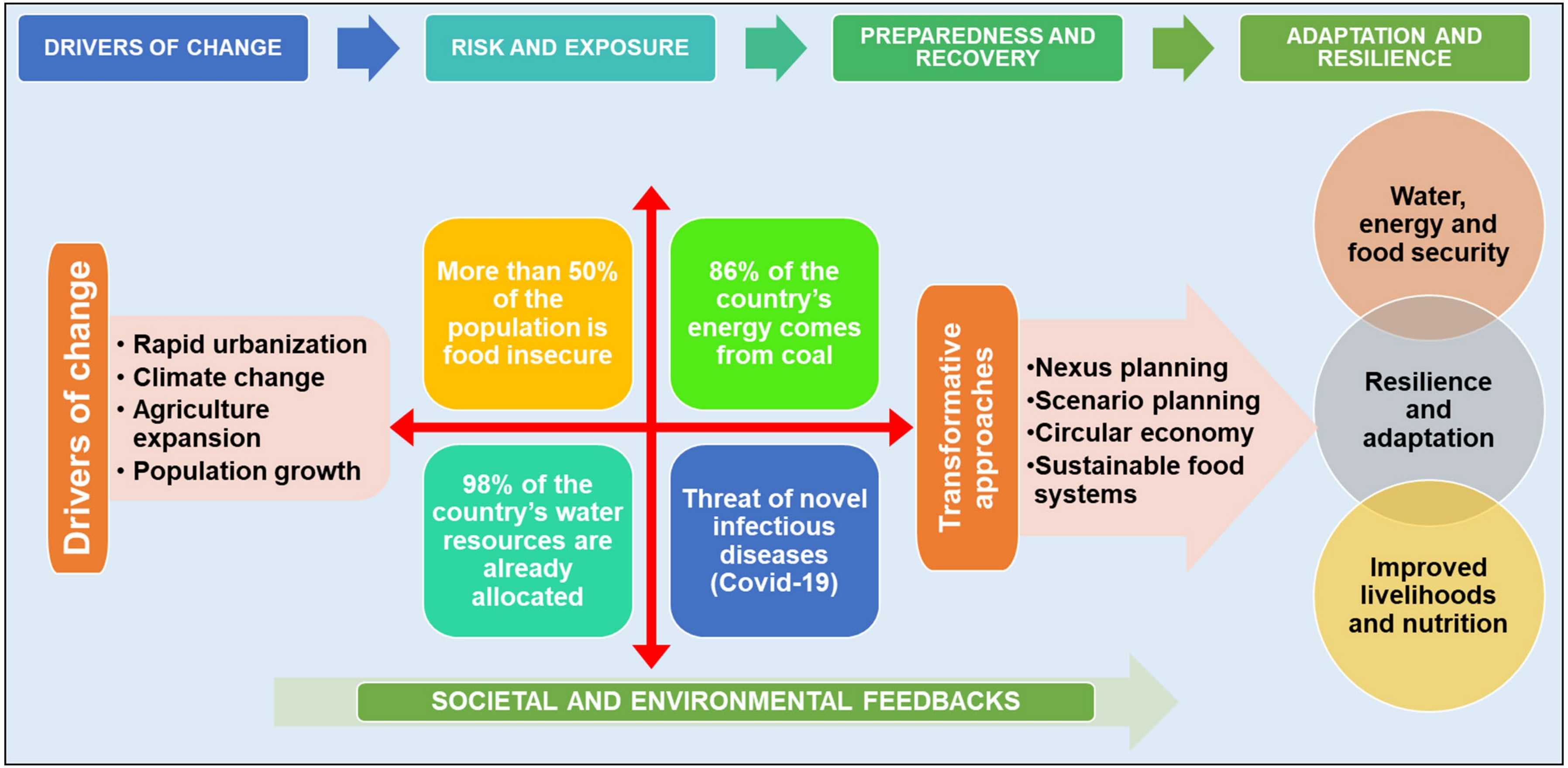
Background: African context

- High levels of poverty
- 56 million people are malnourished
    - 605.8 million people experience moderate to severe food insecurity
- Large percentage of the population still resides in rural areas and are dependent on climate-sensitive natural resources for livelihoods and wellbeing
- 75% of smallholder subsistence farmers produce most of the region's food
    - 80% of farmland in SSA is managed by smallholders
    - They produce the bulk of our food
    - They are threatened by climate variability and change
- 95% of agriculture is rainfed
    - Threatened by recurrent drought, floods, climate variability and change
    - Potential to increase irrigation and improve AWM practices
    - Land, energy, water and environmental constraints



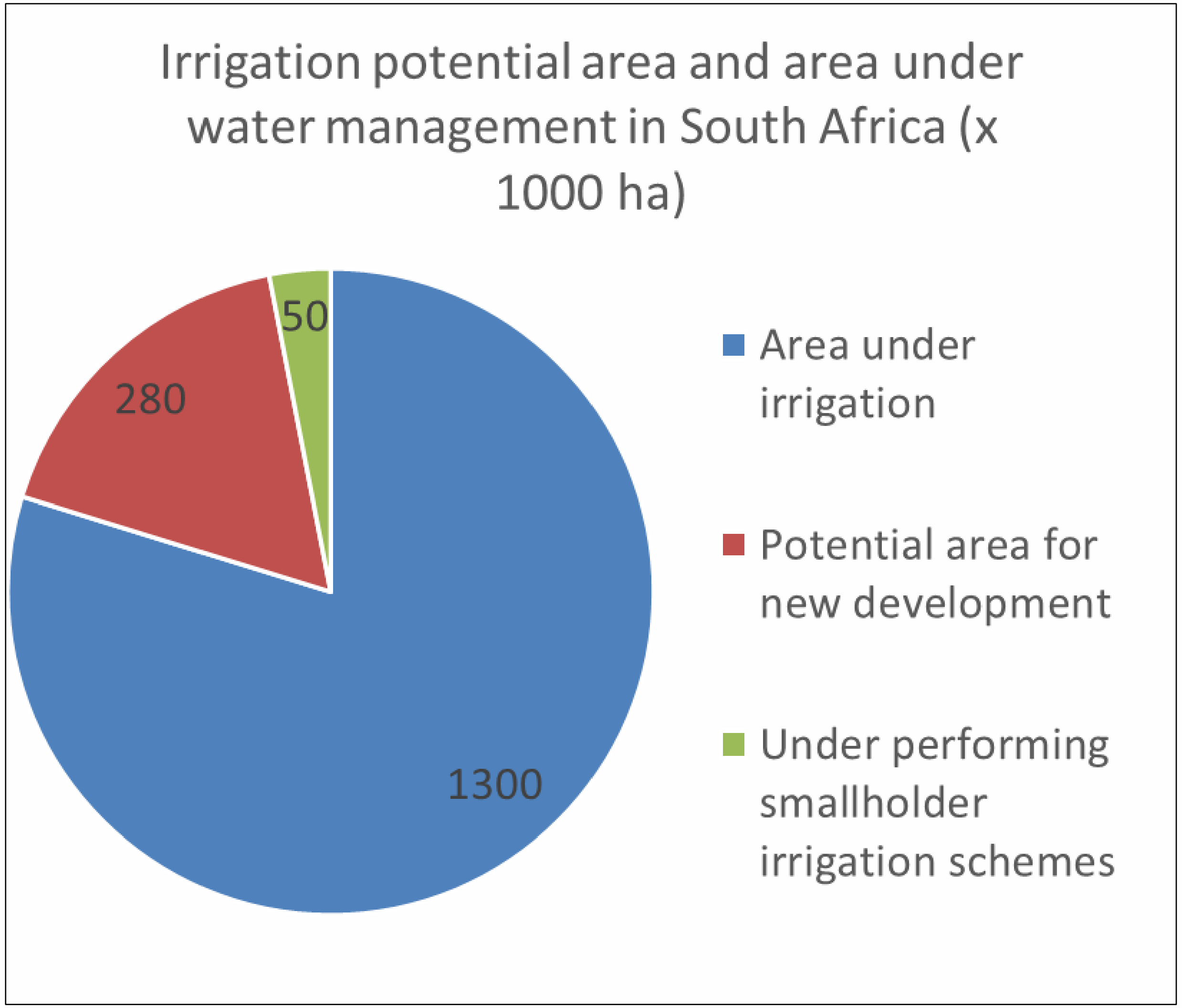
South African context



- A priority of the National Development Plan (NDP) is to increase resilience and agricultural productivity and ensure food security
- The NDP seeks to expand area of land under irrigation land
- However, 98% of South Africa's water resources are already allocated, and
- 62% of available freshwater resources are used for agriculture, mainly for irrigation

Options for increasing agricultural productivity through irrigation

- ❑ Increasing land area under irrigation
- ❑ Integrated water resources management
- ❑ Water-energy-food nexus
- ❑ Alternative water sources
  - ❑ Ground water??
    - ❑ How much is actually available?
    - ❑ Is it sustainable given declining rainfall – recharge rates?
    - ❑ Energy requirements for pumping ground water?



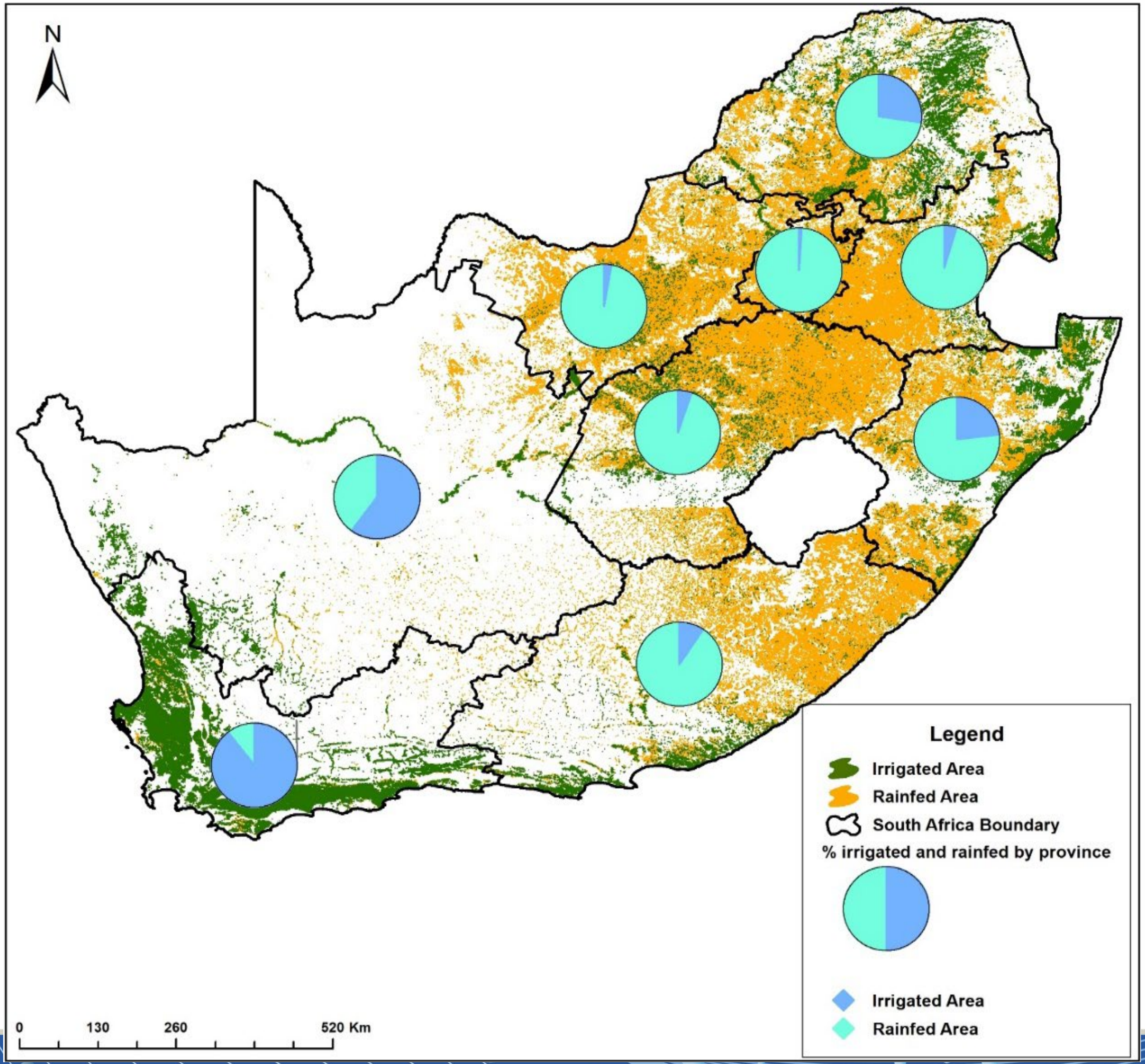
Factors to consider

- **Spatial distribution of water**
- **Infrastructure**
- **Competing industries/uses**
- **Interconnected domains**

– Water-Energy-Food nexus

Scale of intervention

Plant, field or catchment level



Improving irrigation water use efficiencies and productivity

At a crop and field level, improvements in water productivity

- Rainwater harvesting and soil water conservation technologies
- Improved agronomic practices – best management practice for improved WUE Crop choice, intercropping, plant densities, fertiliser use
- Engineering, management and institutional strategies

Improving irrigation efficiency

- Use of micro-irrigation systems (drip and sub-surface irrigation) in place of macro-irrigation systems (overhead and sprinkler type irrigation)
- Irrigation scheduling e.g., deficit irrigation can increase water productivity
- Supplementary irrigation

Water use efficiency vs water productivity

Water use of efficiency WUE)	Water productivity (WP)
A dimensionless ratio of the total amount of water used to the total amount of water applied	Relationship between crop yield and water consumed
Applies to the efficiency of water used suppled to a field	Refers mainly to the benefits from a system (rainfall or irrigated)
Refers to the performance of crops	Refers to the performance of the production system as a whole
It is an assessment of the amount of water taken up by the plant	It refers to the best returns from applied water
Does not consider losses	Loss accounted for through supply or depletion

Technologies developed by the Water Research Commission (WRC)

Digitalisation in Agriculture

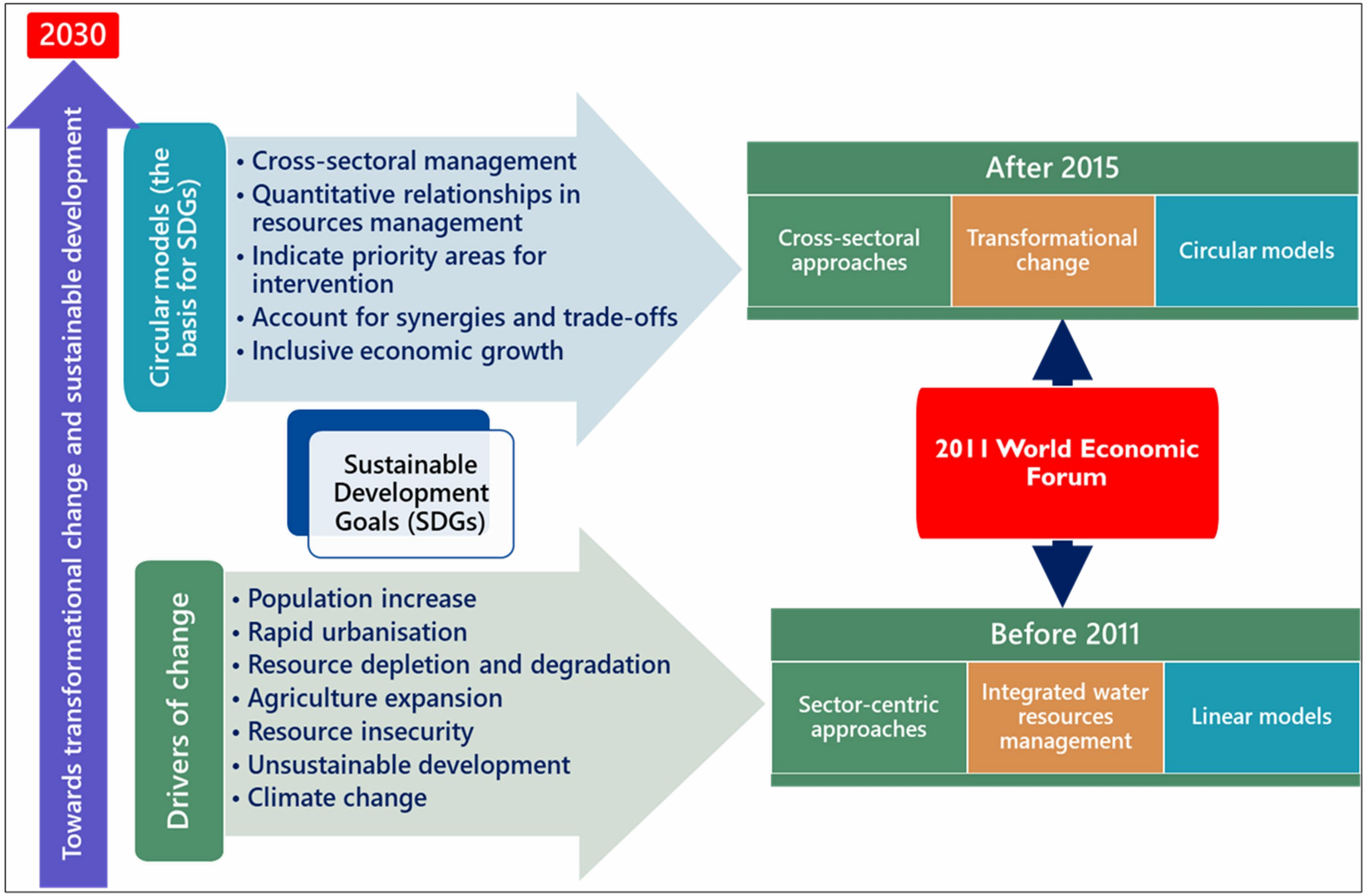
- **ADVANCED IRRIGATION TECHNOLOGIES ALLOW SITE-SPECIFIC IRRIGATION APPLICATION**
- Improve water use-efficiency
- Reducing water usage

- **PRECISION AGRICULTURE**
- Measures and responds to spatial and temporal variability of soil and crop growth
- Enhances profitability and reduces environmental impact
- Technologies involved:
  - ➢ Geographic information systems
  - ➢ Global Navigation Satellite System
  - ➢ Yield monitoring
  - ➢ Variable Rate Technologies

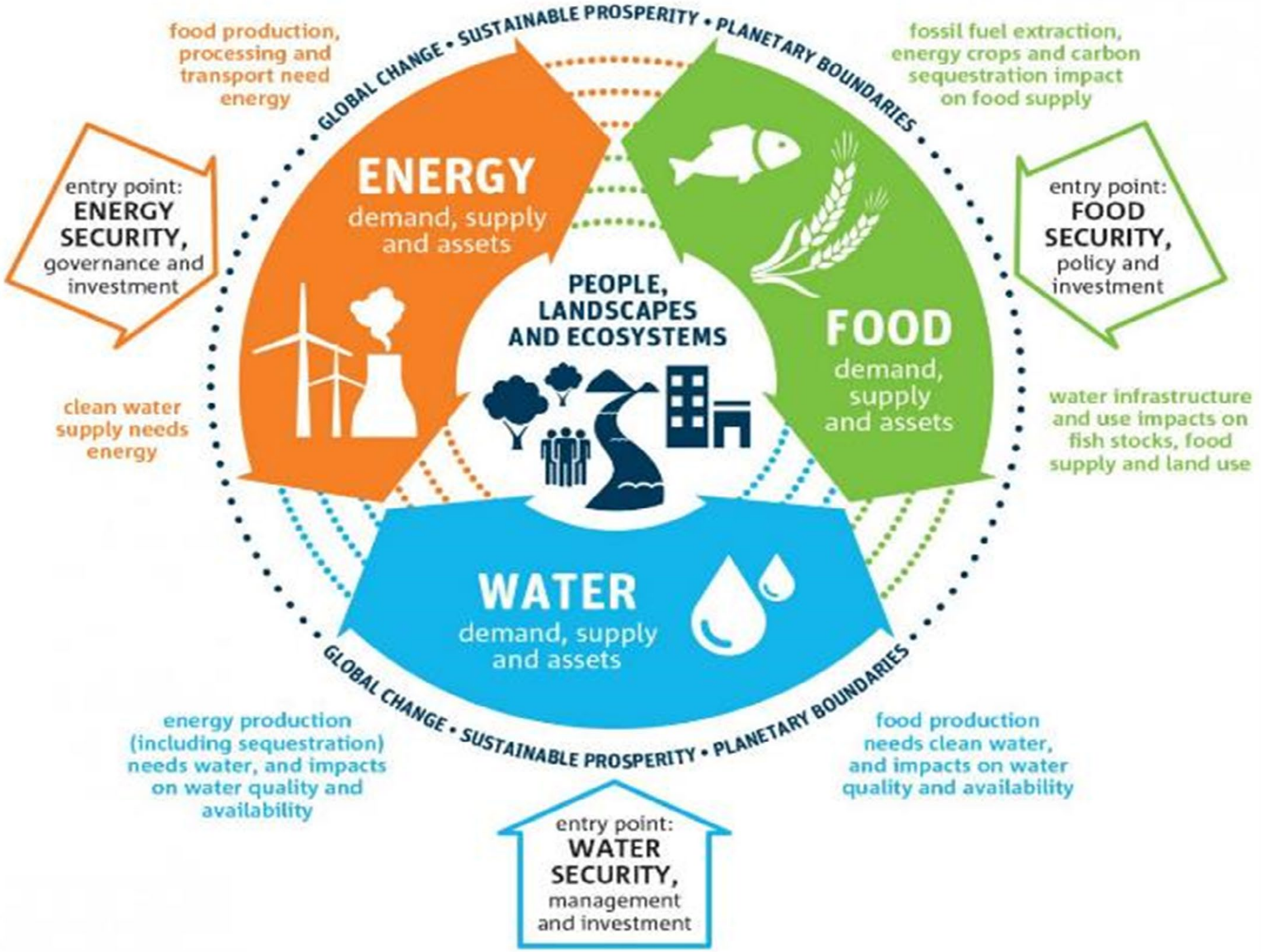
Digital agriculture, important for attracting youth in agriculture and modernizing agriculture

Promoting technology based on local needs

The need for transformational change and nexus planning



Science – Policy Interface



Empower communities to produce own food

- Individual, community and institutional capacity building
- Enhancing capacities and agency of communities
- Combining scientific methods and local knowledge (IKS)
- Build climate resilient farming methodologies into farming practices

for smallholder farmers:

  - Context-specific AWM practices for optimizing rainfed systems
  - Tailored agronomic practices
  - (re)introduce high drought and heat tolerant crops
  - Look at crops with stable yields and good nutritional value
  - Integrated approaches mapped at a whole system level

- Increase yields and access to markets

Recommendations

- Irrigation technologies and improved irrigation scheduling
- Digital agriculture, important for attracting youth in agriculture and modernizing agriculture
- Align interventions with the NDP & SDGs 2, 6 and 7 (Cross-sectoral and nexus planning)
- Build a strong human development at different levels
- Allocate more budgets specifically for technology demonstration across the country

Conclusions

- It is feasible to increase area under irrigation in South Africa for sustainable food production and improve food security
- Targets to increase area under irrigation should be balanced with available water and energy resources
- Investing in small-scale irrigation schemes to develop resilient food systems and strengthening small-scale farmers' capacity to adapt to climate variability and change
- There is a need for human capacity development to ensure that small-scale farmers are equipped to take advantage of the investments
- Adopting a WEF nexus approach will allow for balanced and sustainable increases in agricultural productivity

THANK YOU

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