

# The Water-Food-Energy Nexus, a brief introduction

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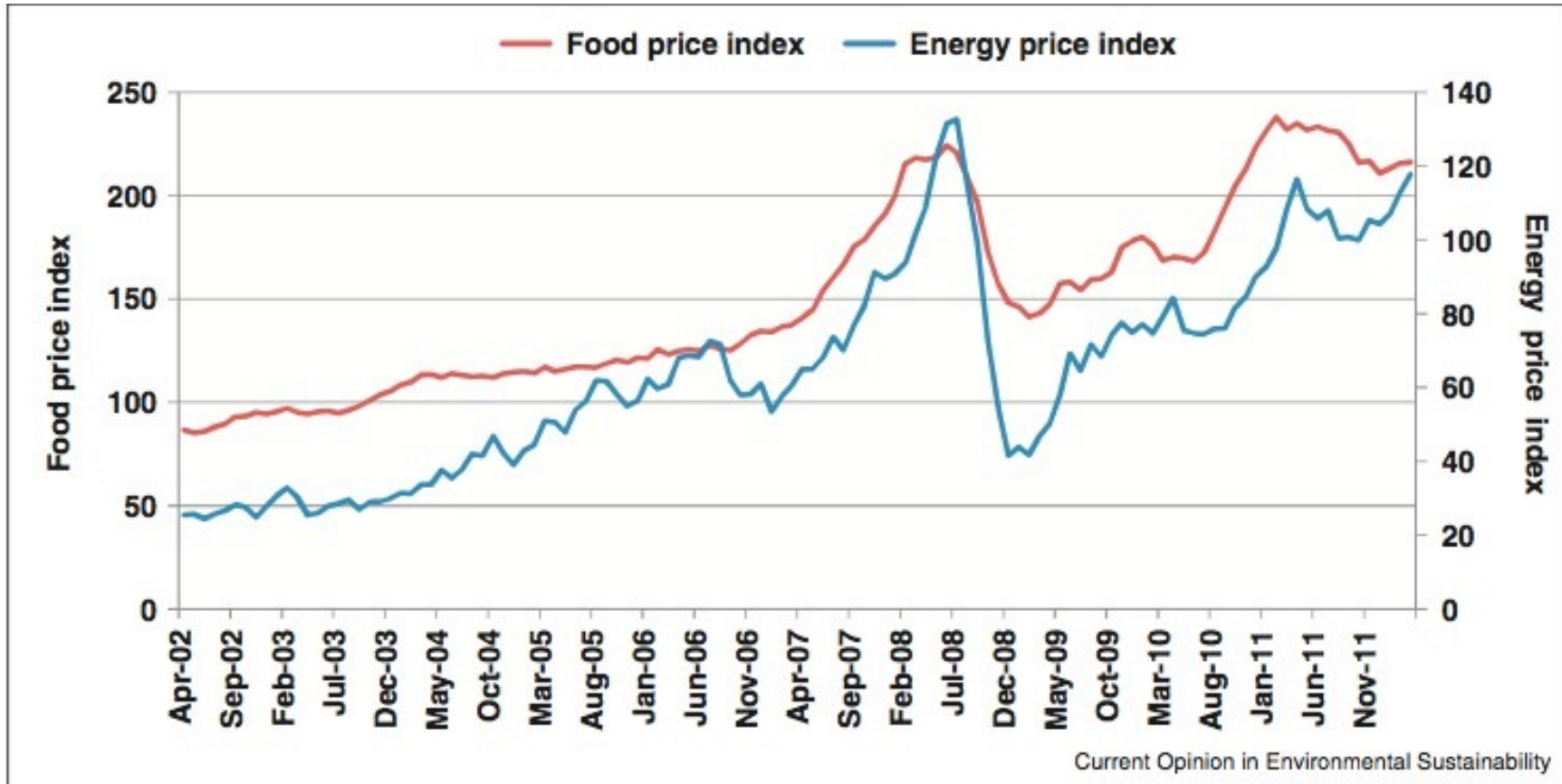
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# Added value of a WFE Nexus approach

- To analyse and understand existing trade-offs and synergies
- To increase visibility of interactions between systems at different scales (Hayes & Crilly 2015)
- To increase efficiency and the governance capacities regarding interplays between Water, Food and Energy
- To deal with externalities between different sectors considering the global efficiency of a system rather than the productivity of a single sector (Leck et al. 2015)



# WFE Nexus: a starting point



World food and oil prices, April 2002 to March 2012 [10,11].

Source: Ringler et al. 2013



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# History and evolution of the concept (1)

- First appearance: World Economic Forum 2008-2009
- A context of crisis: a sudden raise of food and energy prices
- The fear of shortage, of lack of natural resources
- The will to secure supplies
- The tendency of a “new realism” for the management of natural resources (Wales and Winston 2012) →
  - Reinforced collaboration between the public and the private sectors
  - A nexus perspective seen simultaneously as an opportunity and as a constraint for the private sector (Allouche et al. 2014)
  - A perspective considering intersectoral relationships with the lenses of a chain of values
  - The will to escape from silos thinking



# History and evolution of the concept (2)

- The World Economic Forum support the following argument:
  1. National economies must allocate water resources to the uses that allow the best economic value for each liter of water that is used
  2. Instead of conventional agriculture, the need to focus on energy production, industry and manufacturing
  3. States have to allocate water in function of the best financial return
  4. State have to invest in efficient water consumption technics for agriculture → more crop per drop
  5. Promotion of reinforced commercial trade between countries
- **An argument that is based on the identification of synergies and return on investment between the different sectors of activity for an efficient use of natural resources (and of water in particular)**



# History and evolution of the concept (3)

- Next to this World Economic Forum perspective, the Nexus approach enters a new dimension with the Bonn Conference 2011 (in preparation of Rio + 20)
- 3 elements are underlined:
  1. A pressure on natural resources does exist
  2. Risks of shortage concerning water, energy and food sectors does exist
  3. Water, energy and food are interdependent and need an integrated management



# History and evolution of the concept (4)

- The WFE Nexus is considered as an approach (Hoff 2011)...
  - that integrates the management and governance of these sectors in a multiscalar perspective;
  - that allows to reduce trade-offs – « winners-losers »;
  - that focuses on the identification of possible synergies between sectors of activity.



# WFE Nexus - Definition

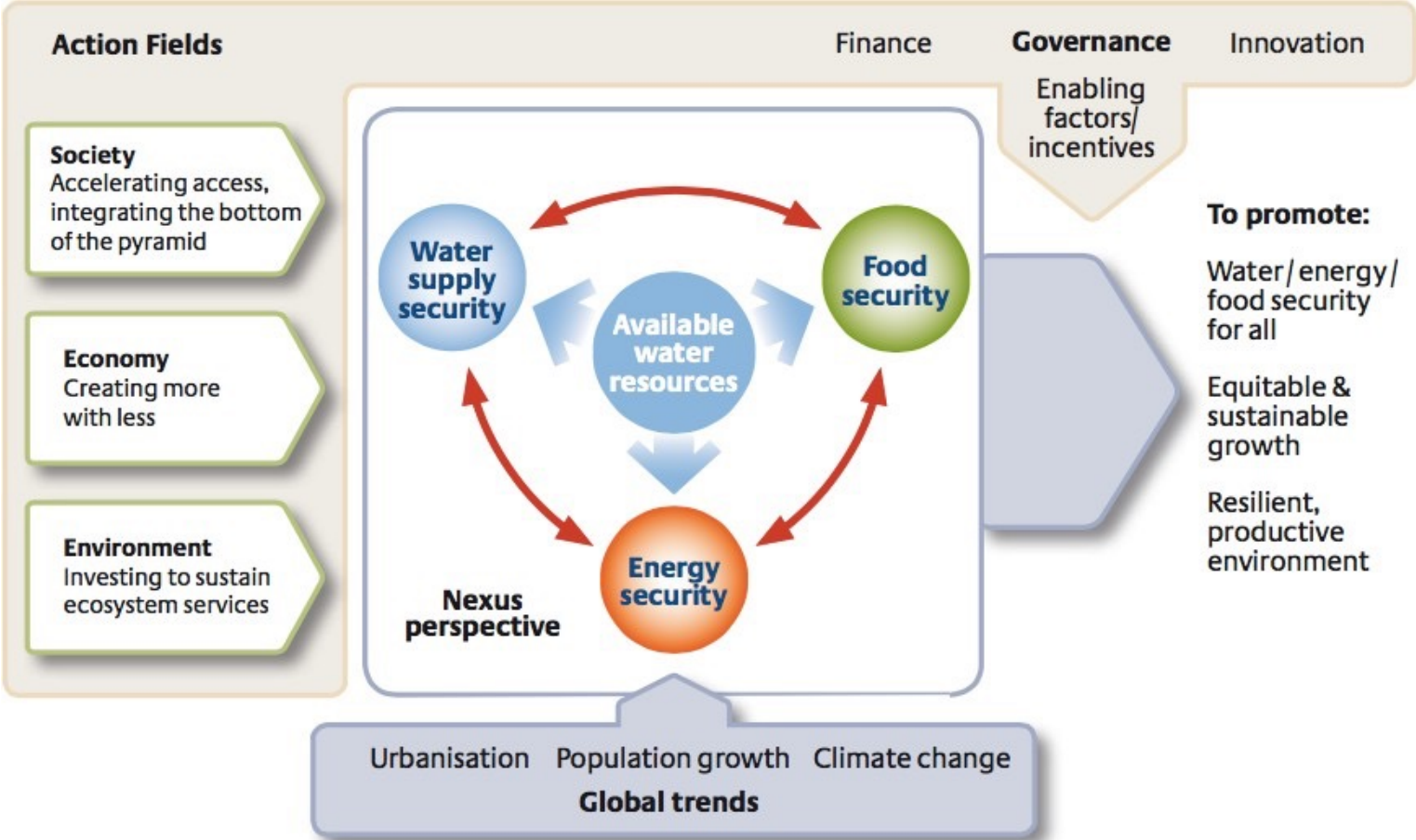
*“The nexus approach means systemic thinking and a quest for integrated solutions to guide decision-making about resource use and development, to minimize externalities and ensure true sustainability.”*

(Source: Stockholm Environmental Institute)





# A systemic approach (1)

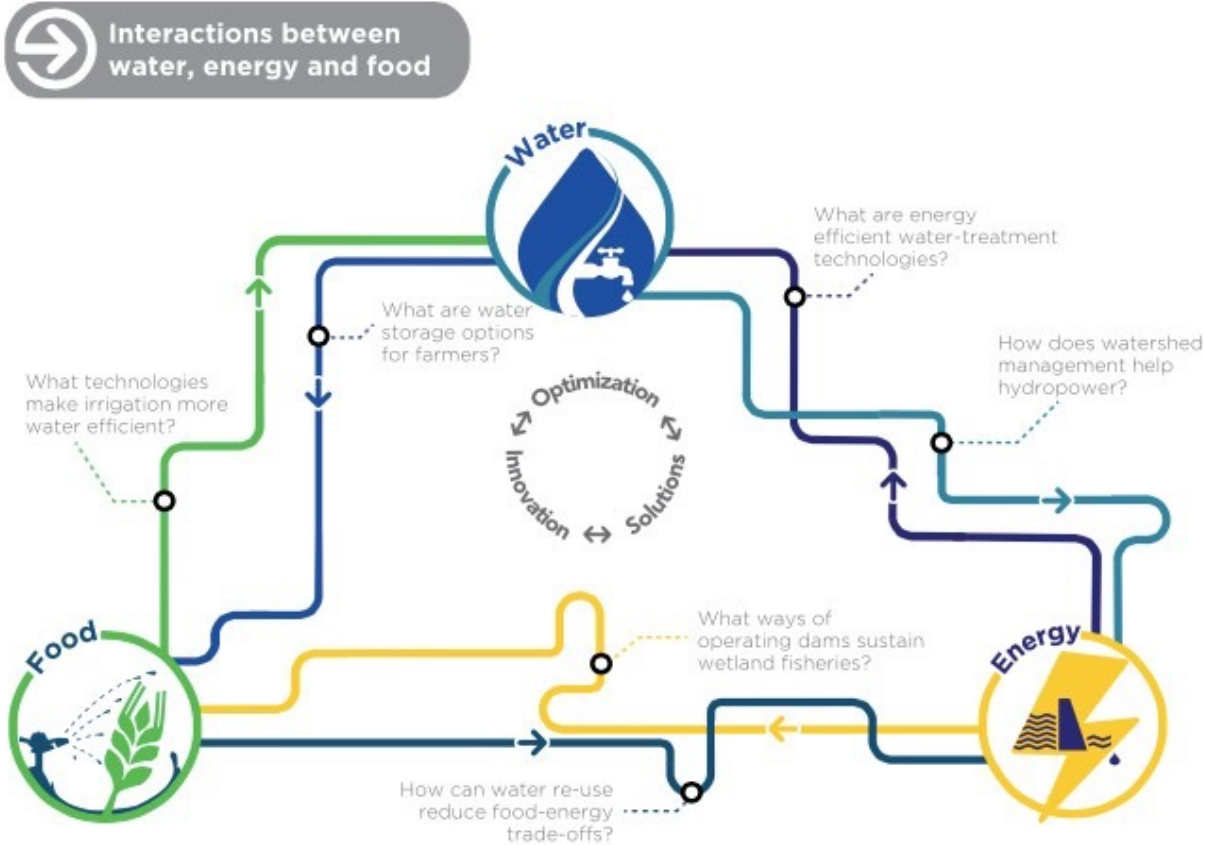


Source : Hoff 2011



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# A systemic approach (2)



Source : Gyawali 2015

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# Sectoral challenges and interactions (1)

## WATER

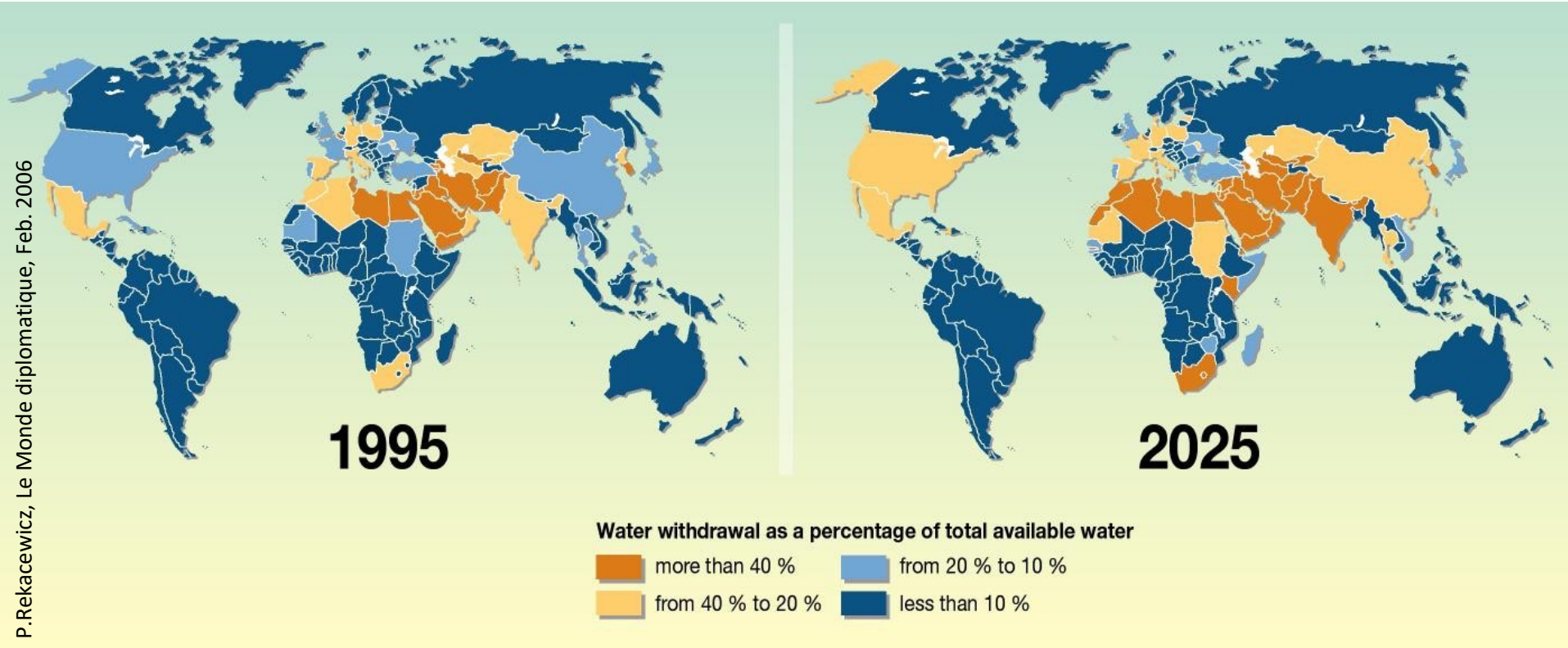
- Difficulties to substitute
- A key resource both for energy and food security
- Renewable but inequally distributed

## ENERGY

## FOOD



# Sectoral challenges and interactions (2)



# Sectoral challenges and interactions (3)

## WATER

- Difficulties to substitute
- A key resource both for energy and food security
- Renewable but inequally distributed

## ENERGY

- Mainly depending from fossil energy
- Increasing production of renewable Energy

A similar tendency for the energy needs related to transport → biofuel

## FOOD



# Sectoral challenges and interactions (4)

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## ENERGY

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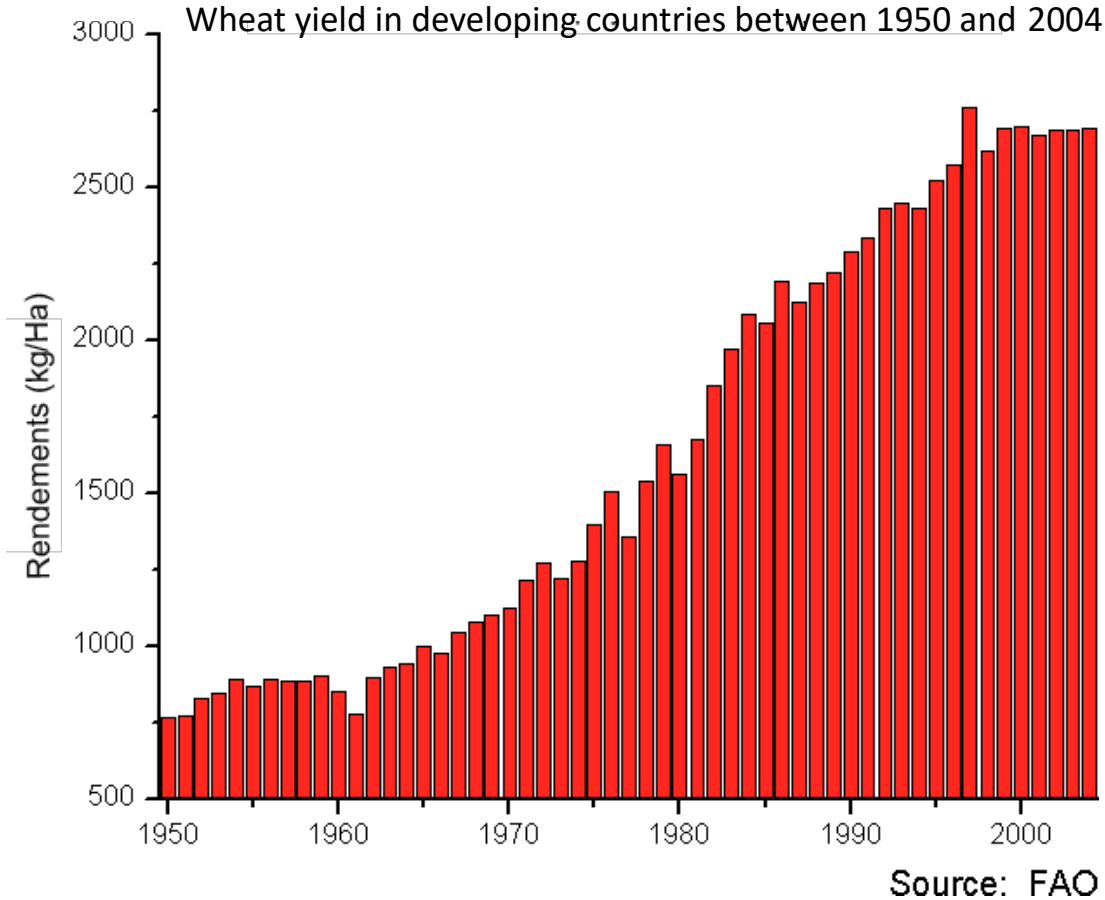
A similar tendency for the energy needs related to transport → biofuel

## FOOD

- An increase of food production capacities
- An increase of land dedicated to agriculture and/or an intensification of production



# Sectoral challenges and interactions (5)



# Sectoral challenges and interactions (6)

## BIOFUEL

- Brazil : the will to reinforce its capacities regarding biofuel production
- Subsidized production of biofuel
- Increase of the competition with water and land use (notably deforestation)

Source : Hoff 2011

## HYDROPOWER

- 60 millions of inhabitants that depend from the Mekong river (directly and indirectly)
- Till 2030, 88 projects of new dams
- A loss of 22 to 38% of proteins that is provided by fish stocks
- Economic and public health impacts → a new food paradigm

Source : Orr et al.2012

## IRRIGATION

- In South-Africa, an increase of electricity prices equivalent to 31% between 2009 and 2010
- Irrigation as an important electricity consumer
- 25% of basic food depend directly on irrigation
- This dependency : a risk for the national food security

Source : Bazilian et al. 2011





# Criticism (1)

- Water-Food-Energy Nexus : *the new kid of the block* (Allouche et al. 2015)
- Multiplicity of definitions and conceptualisations
- **What is new in comparison with previous approaches (IWRM notably)?**
  1. A perspective less focused on water only
  2. No territorial unit considered as reference point
  3. A perspective driven by the efficient use of resources
- **How to operationalize a concept that implies a strong complexity?**
  - What should be integrated ?
  - Which data ? What availability of data ?



# Criticism (2)

- **Insufficient theorisation and politicization of the concept (Middleton & Allan 2014)**
- **An analysis of institutions and governance mechanisms that needs further development**
  - Who is in charge of integration?
  - Who will provide arbitration?
  - How to implement integration?
  - How do power variables influence the process?
- A western perspective on the management of natural resources

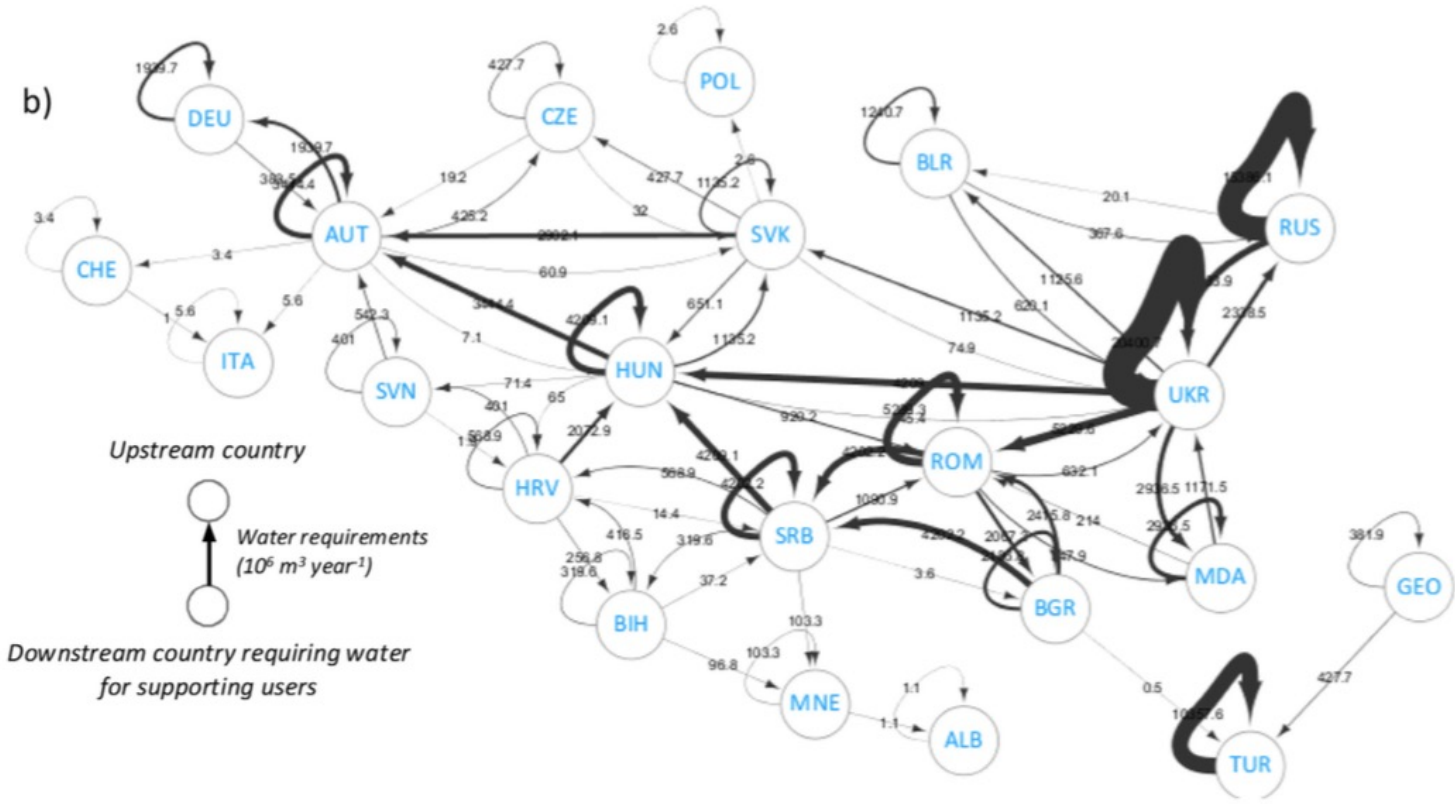


# Analytical added-value (1)

- A framework that
  - attempts to grasp the complexity of natural resources allocation
  - allows to reflect on causal links that structure a chain of value
  - allows to critically reflect and assess the practices of sectors and existing interactions
  - allows to analyse natural resources allocation in a multi-level perspective
  - makes feedback loops between different sectors more explicit
  - allows a better understanding of risks and measures that can be undertaken (Gallagher et al. 2016, Grafton et al. 2016)



# Analytical added-value (2)



ALB = Albania; AUT = Austria; BLR = Belarus; BIH = Bosnia and Herzegovina; BGR = Bulgaria; HRV = Croatia; CZE = Czech Republic; GEO = Georgia  
 DEU = Germany; HUN = Hungary; ITA = Italy; MKD = Macedonia; MDA = Moldova; MNE = Montenegro; POL = Poland; ROM = Romania  
 RUS = Russia; SRB = Serbia; SVK = Slovakia; SVN = Slovenia; CHE = Switzerland; TUR = Turkey; UKR = Ukraine

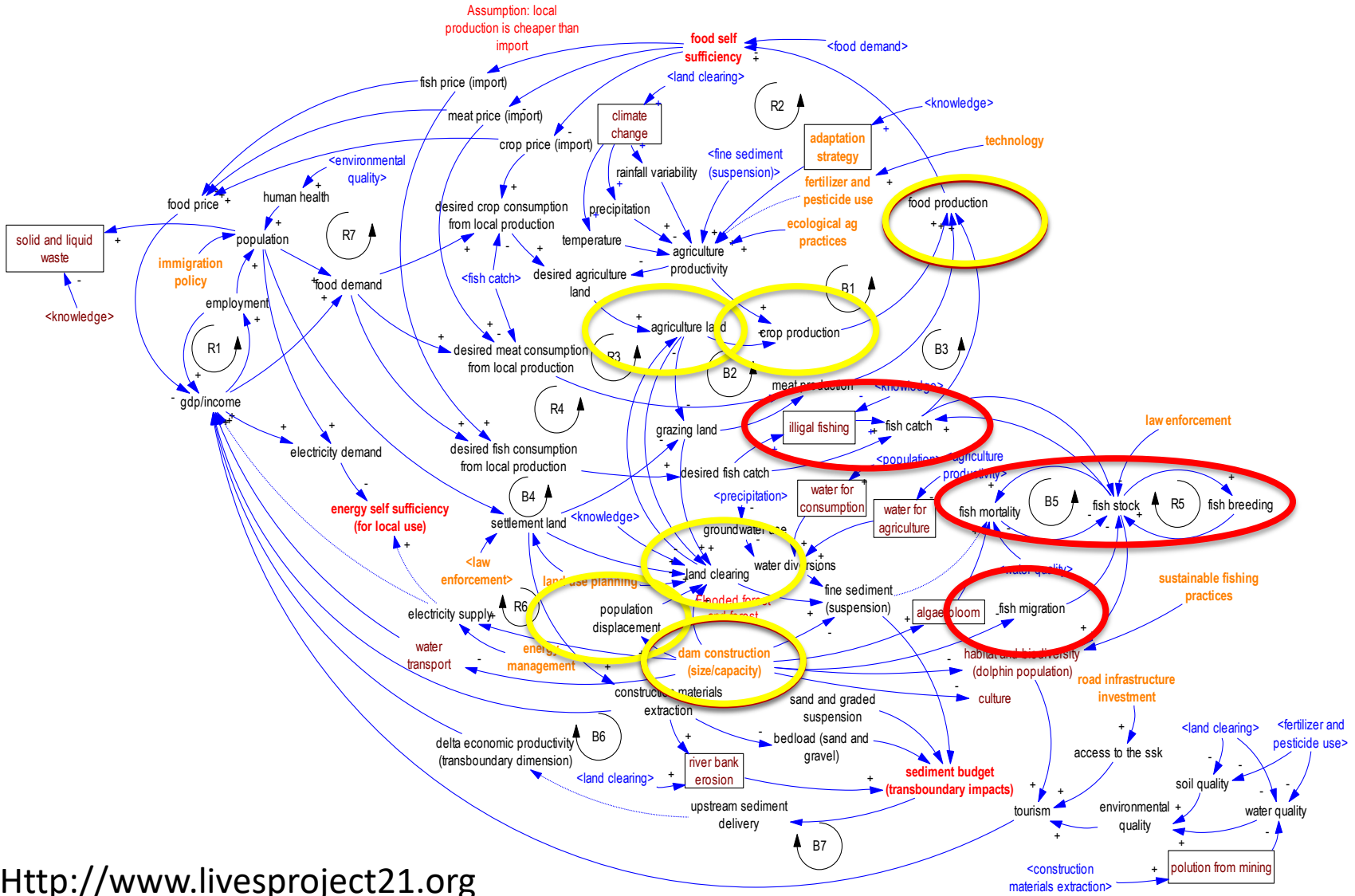
Fig. 6. Relations among adjacent countries in terms of (a) water consumptive use and (b) requirements, both in  $10^6 \text{ m}^3 \text{ year}^{-1}$ .

Source: Fasel et al. 2016



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# Analytical added-value (3)



# Analytical added-value (4)

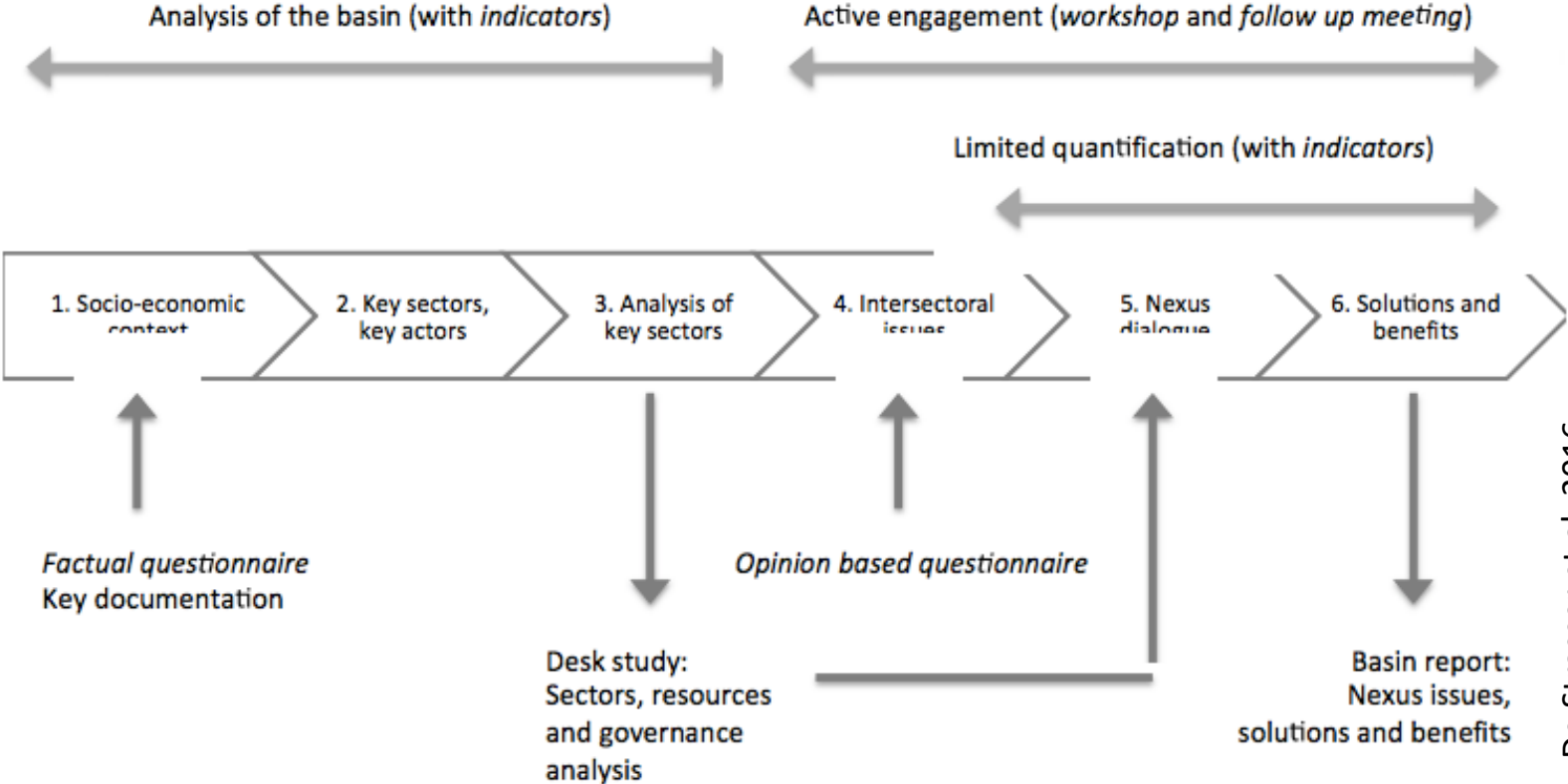


Figure 1. Schematic of the six steps with inputs and outputs.

Source: De Strasser et al. 2016



# Nexus approach: possible developments (1)

- A multi-scalar perspective of sectoral interactions (technical, institutional): tailor-made responses
- Flexibility and adaptive capacities of governance frameworks: centralisation vs decentralisation
- Inclusion and participation along the value-chain: Who to include? How? When? Always useful?
  - The Nexus as a inclusive tool
- Science and global changes
  - The role of science, the role of technology



# Nexus approach: possible developments (1)

- The technical and economic dimension hide a larger debate about inclusion
- SDGs as a relevant and critical platform

