

Fertilizing Solutions on the WEF Security Nexus from a Sustainable Supply Chain Management Perspective

*BHP Billiton Sustainable Communities/UCL Grand
Challenges Symposium
Global Food Security: Adaption, Resilience and Risk*

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Structure

✓ *Introduction and Concept*

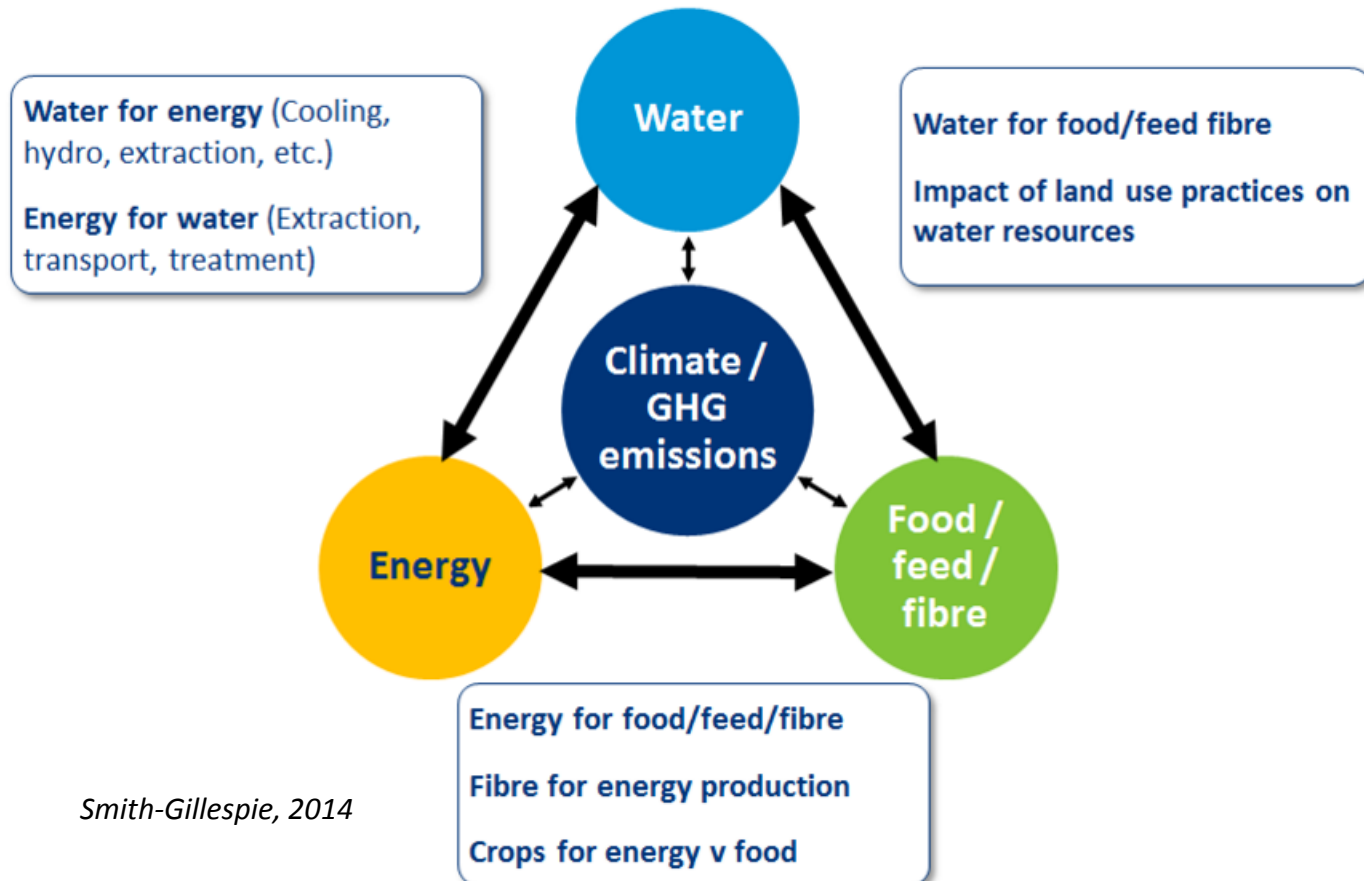
- Motivation and Innovation
- Sustainable Supply Chain Management (SSCM) and WEF Security Nexus
- Policy Relevance

✓ *Methodology and Rationale*

- WEF Nexus, factor/driver definition within interactions
- Scenario development based on System Dynamics and Agent-Based Modeling and Simulation for WEF nexus

✓ *Consortium*

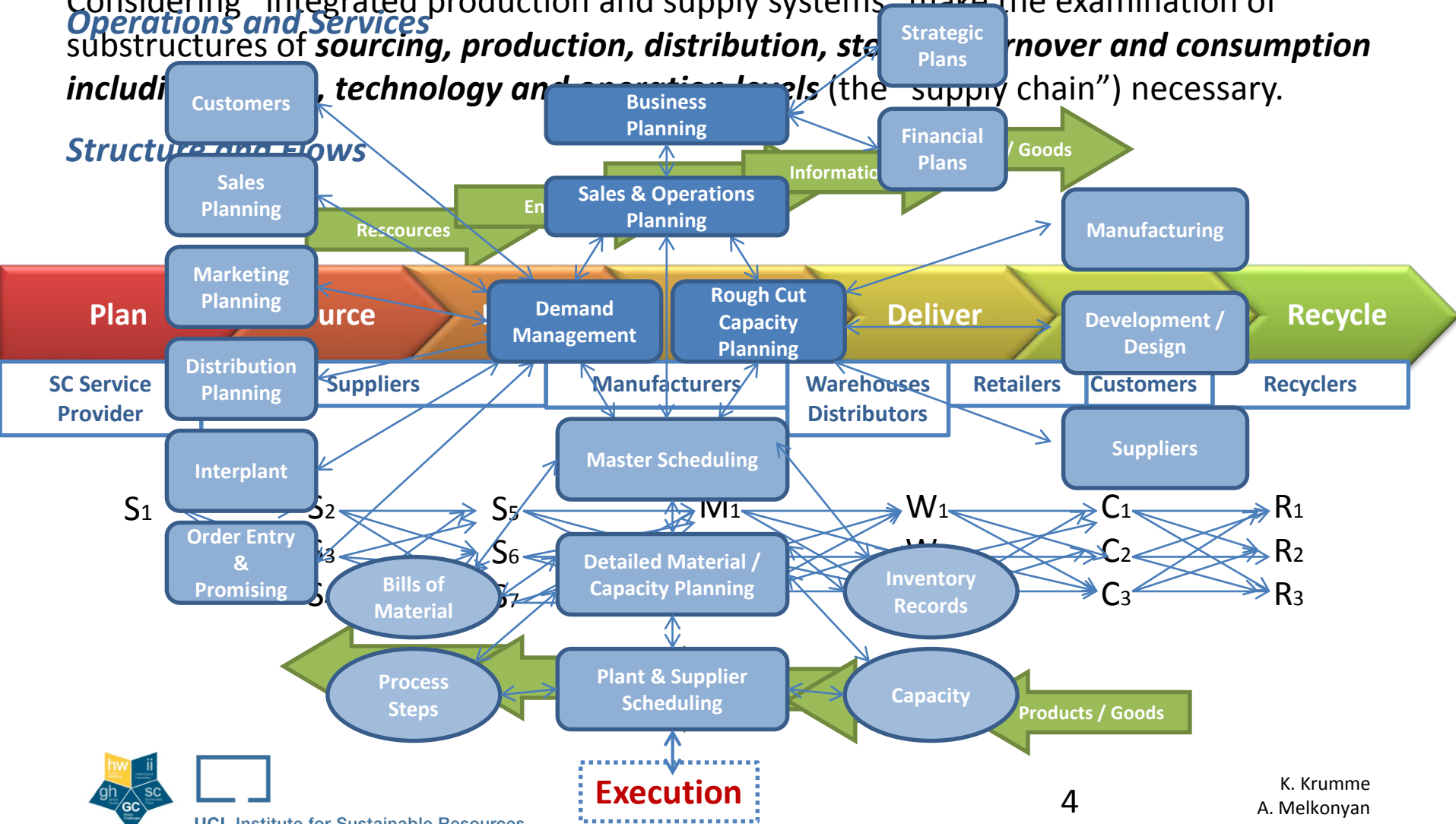
Challenge: Food Water Energy Security under Climate Change



Smith-Gillespie, 2014

Integrated Production and Supply Systems

Considering “integrated production and supply systems” make the examination of substructures of **sourcing, production, distribution, storage, turnover and consumption** including **technology and operation levels** (the “supply chain”) necessary.

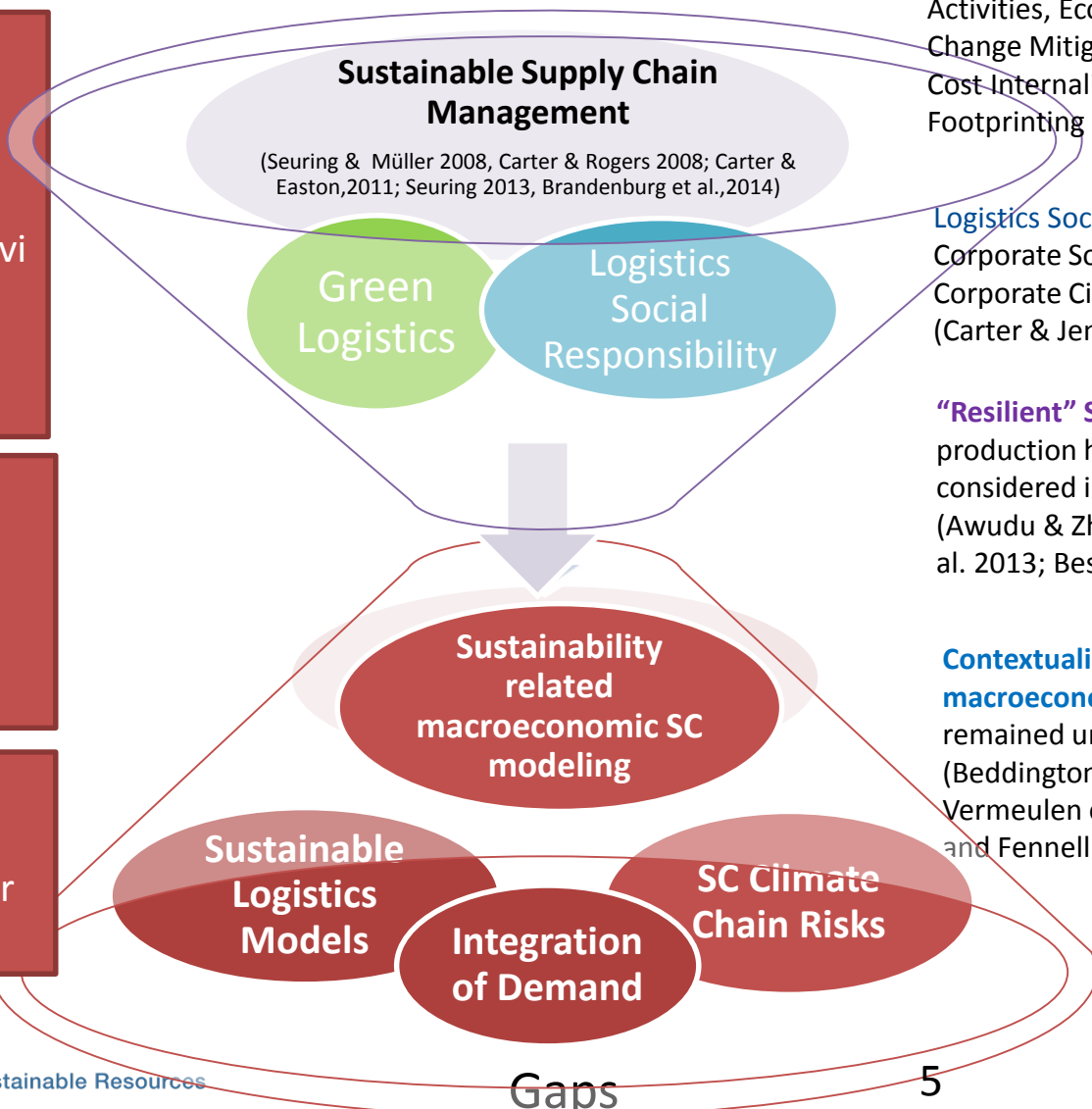


Literature Review on SSCM and Gaps

StA of SCM has not considered **demand** related drivers (see: Kouvelis et al. 2006, Chopra 2007, Simchi-Levi et al. 2008). A basis for Sustainability Thinking in Supply Chains!

SSCM provided first conceptual outlines but never related them to **“strong sustainability models”**

The direct supply chain relation to **climate change risks** stays under represented



Green Logistics: Environmental Impacts of Economic Activities, Eco-Efficiency, Climate Change Mitigation, Environmental Cost Internalisation, Ecological Footprinting

Logistics Social Responsibility (LSR): Corporate Social Responsibility, Corporate Citizenship, Labour Issues (Carter & Jennings 2002)

“Resilient” SC on (agricultural) production have only been considered in the recent years (Awudu & Zhang 2012; Fiksel et al. 2013; Beske et al. 2014)

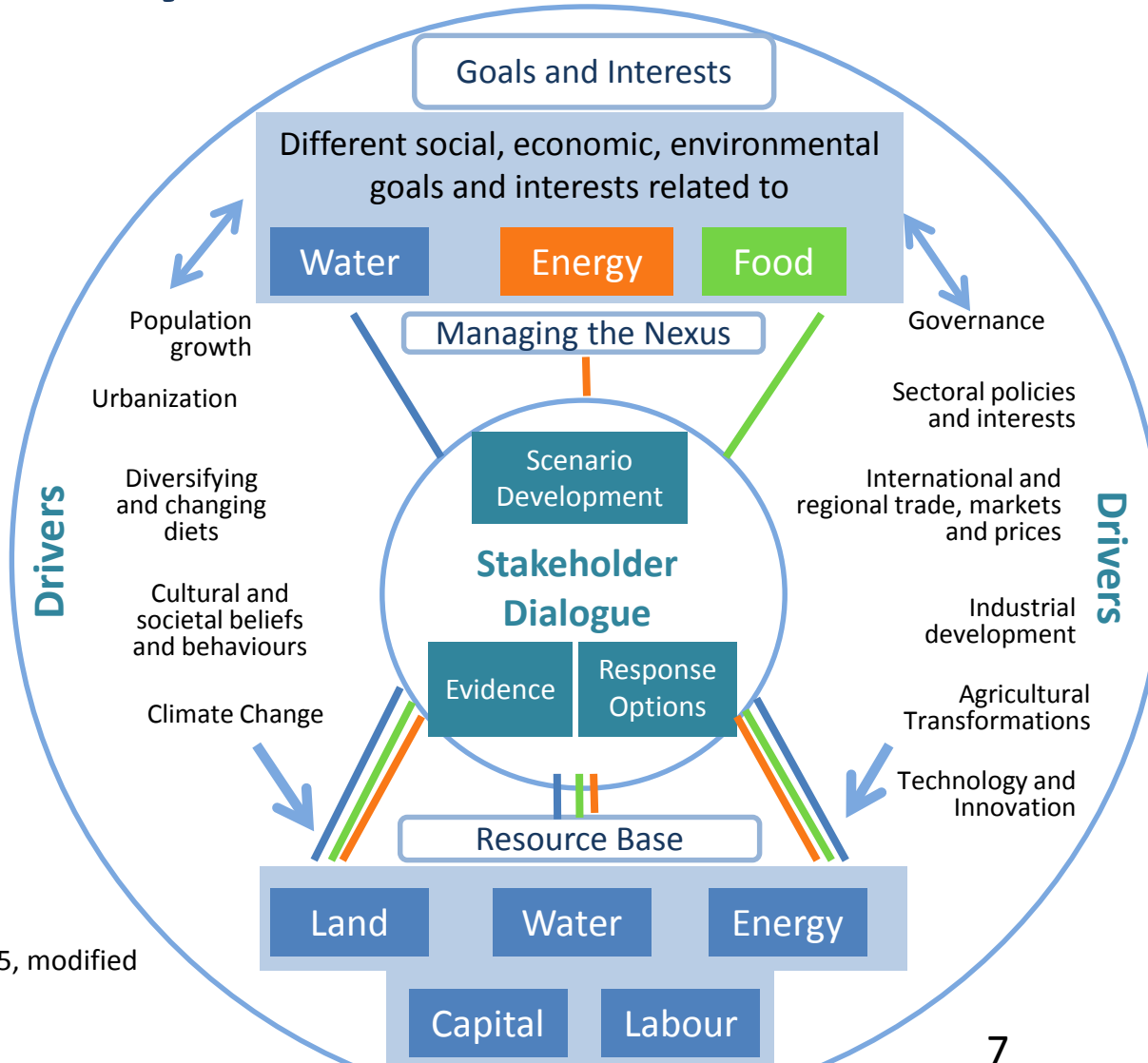
Contextualization to macroeconomic modelling remained unexplored (Beddington et al. 2012; Vermeulen et al. 2012; Thorpe and Fennell 2012)



General Demand for an innovative research design

- A methodological approach to innovate *Supply Chain Domains* (Structures & Services) based on Resilience Design
- Display of occurring *functional overlaps* in the nexus: Energy, Water and Food
- Conceptual and economic harmonization of bio-energy and food production as “*Organic Supply Chains*”
- *Advanced Ecological Footprinting* (EF) Models as „pull factors“ of innovation
- *Material Flow Analysis, Advanced LCA, Scenario Building* based on Dynamic Network Methods (DNM), *Modelling and Simulation*

Dynamics in the WEF Nexus



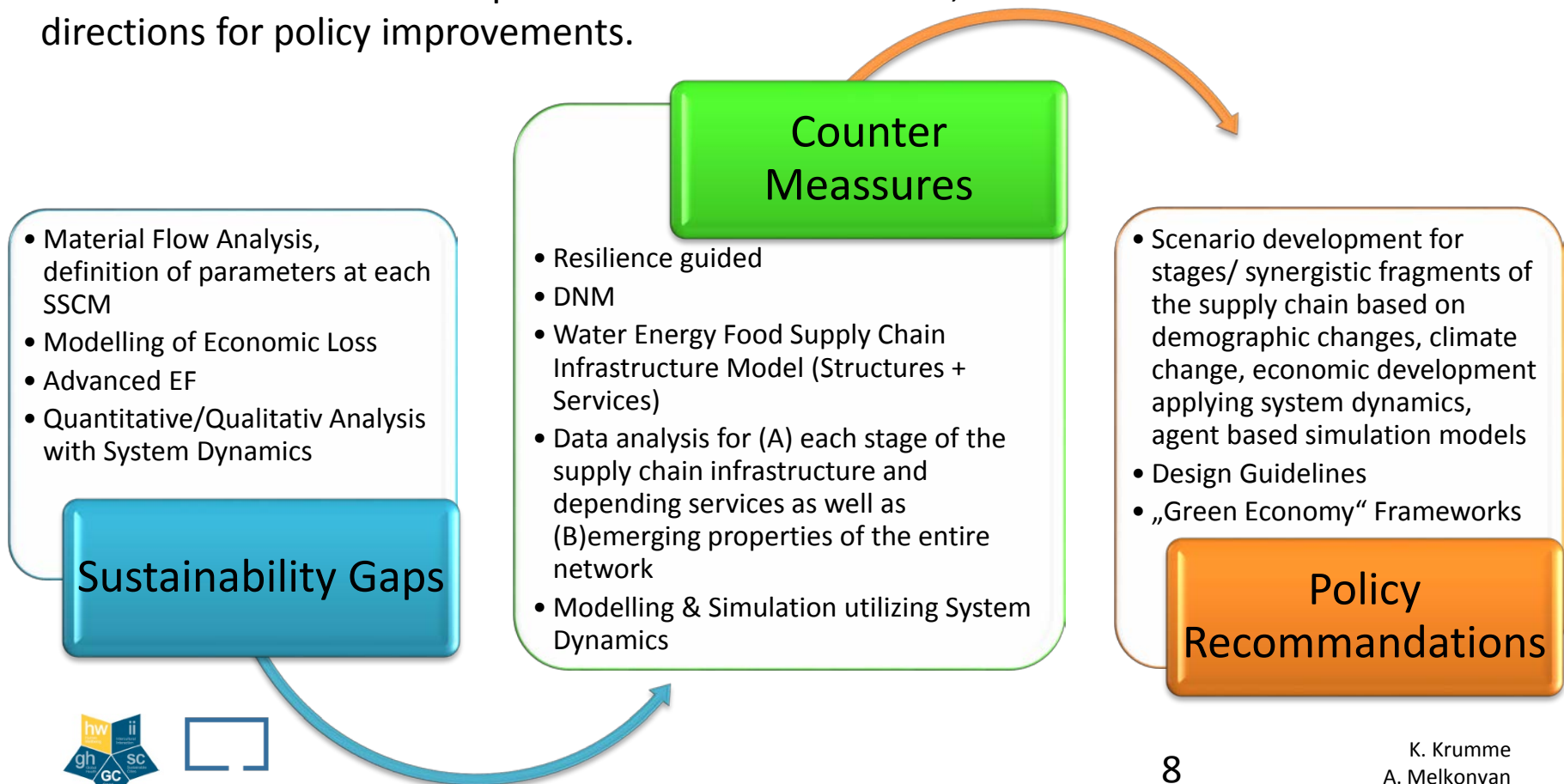
FAO, 2015, modified



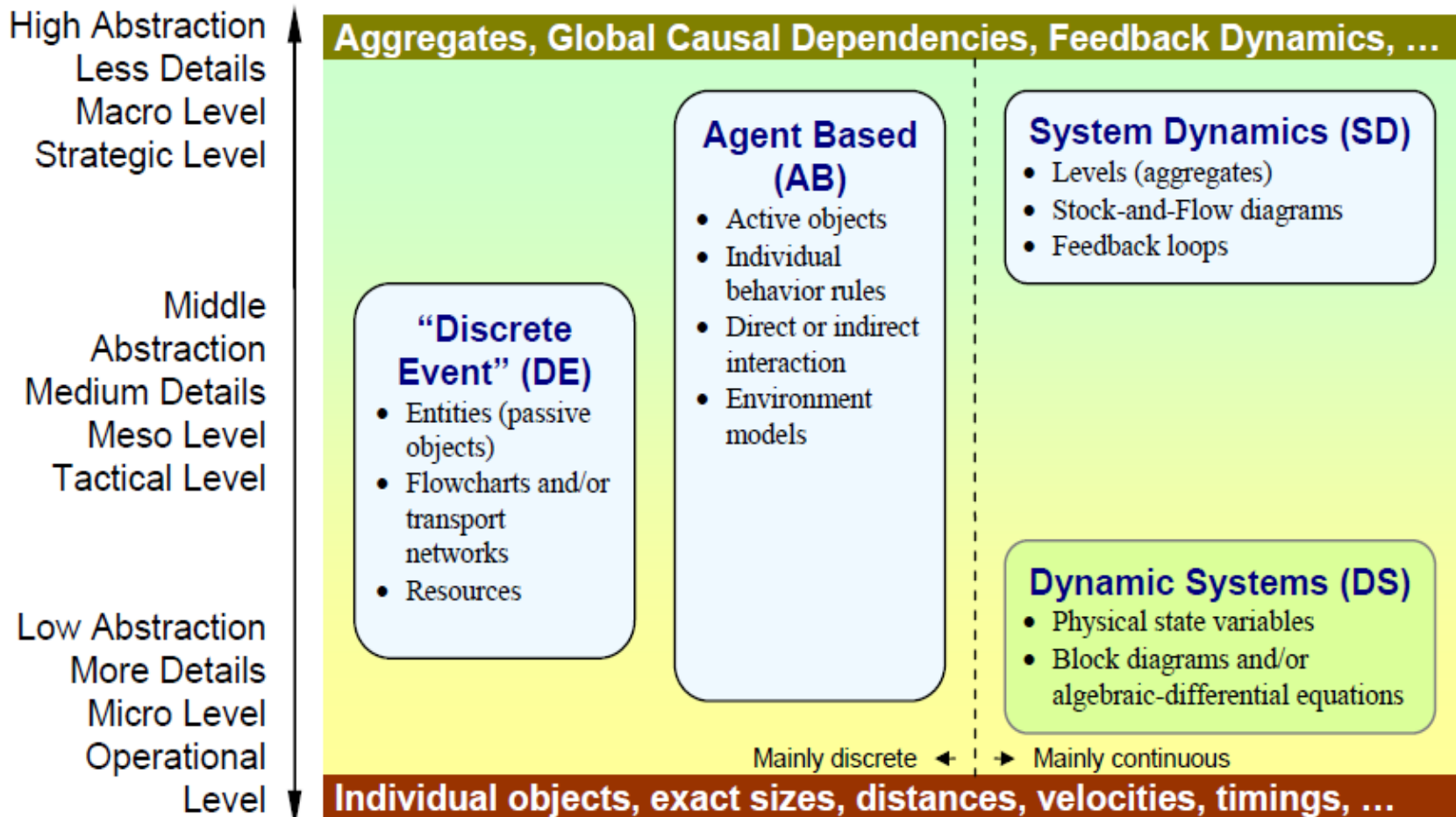
UCL Institute for Sustainable Resources

Rationale of the approach

Sustainable Supply Chain Management (SSCM) could fertilize the WEF nexus with a combination of quantitative analyses of sustainability gaps with corrections and counter measures on the operational economical level, and could indicate valuable directions for policy improvements.



From System Dynamics to Agent Based Modelling



Physical modelling - where individual objects with exact sizes, distances, velocities and timings matter

Borshchev & Filippov, 2004

Thank you for your Attention



Cooperation Partners (Target Countries)

South Caucasus, Armenia/ Georgia

- *Yerevan State University, Faculty of Economics; University of Agricultural Research; Ministry of Nature Protection, Armenia, and office of UNDP in Armenia and Georgia; Ministry of Environmental Protection, Georgia, National Environmental Agency; National Hydrometeorological Service of Armenia*
- **Research Profile:** *Economic analysis/ modeling of climate change impacts on **agricultural** production sector and water management issues. Supply purposes investigated are mainly dedicated to **national consumption markets.***

South America, Brazil

- *Federal University of Rio de Janeiro, Coppe, Graduate Studies and Research in Engineering, Transport Engineering and Supply Chains*
- **Research Profile:** *Organic Production and Supply Systems under Climate Change with respect to **a)** GHG emission mitigation for supply chain infrastructures for Rio de Janeiro, **b)** eco-efficiency analysis of soy export corridors for the international market, **c)** competitive organic supply chains (energy/ food) in respect to tradeoffs/ synergies*

North-Africa, Egypt

- *Arab Academy of Science and Technology in Alexandria; Renewable Energy and Sustainable Development*
- **Research Profile:** ***a)** Regional bio-energy/ renewable energy production and supply systems and conflicting regional climate change impacts, **b)** energy supply for the megacity Alexandria and its greater coastal region*

East-Africa, Kenya

- *Kenyatta University Nairobi; Physical Geography and Agro-Climatology; Kenya Agricultural Commodity Exchange Limited*
- **Profile:** *Regional food production and supply systems under climate change, particularly for **a)** sources for urban supply of the centrally “inland” located metropolis Nairobi, **b)** impacts on international production and supply systems for agricultural commodities on the **global market.***

Further Scientific Companion Institutions



- **Prof. Dr. Malcolm O. Asadoorian**, Environmental Economics, Regis Colleague at Harvard University, USA
- **Prof. Dr. Raimund Bleischwitz**, Environmental Economics, BHP Bilton Chair in Sustainable Global Resources
- **Prof. Dr. em. Gerd Förch**, Integrated Watershed Management, Makerere University, Kampala/Uganda (visiting Professor DAAD Herder Programme at College of Agriculture and Environmental Sciences)
- **Prof. Dr. John D. Groesbeck**, John R. Kuhn Professor of Business and Economics, Missouri Southern State University, USA
- **Prof. Dr. Arjen Hoekstra**, Water Management, University of Twente, Netherlands, Advisor to e.g. UNESCO and the World Bank; founder and chairman of the Water Footprint Network (WFN)
- **Prof. Dr. Riccardo Manzini**, Director of the "Food Supply Chain Center & LAB", ALMA MATER STUDIORUM - Bologna University, Italy;
- **Prof. Dr. Antonella Samoggia**, Agricultural Sciences, Rural economy and evaluation, agri-environmental measures, ALMA MATER STUDIORUM - Bologna University, Italy
- **Prof. Dr. Uwe Schneidewind**, Wuppertal Institute for Climate, Environment and Energy, Germany, President; i.a. Member of the German Advisory Council on Global Change and the Club of Rome
- **Prof. Dr. Metin Türkay**, Koc University, Turkey; Director of the KOÇ-IBM Supply Chain Research Center
- **Prof. em. Dr. Bert de Vries**, Global Change & Energy/ Sustainability Science, Member of the Intergovernmental Panel on Climate Change (IPCC)
- **Prof. Dr. Ying Zhao**, Agricultural Economics, Northwest Agriculture and Forestry University, Shannxi, China (College of Natural Resources and Environment)
- **Prof. Dr. W.H.M. Zijm**, Production & Supply Chain Management/ Operations Research, University of Twente, Netherlands (Co-Chair of the Alliance for Logistics Innovation through Collaboration in Europe (ALICE))



Partnering International Policy & Stakeholder Organization:

- **Food and Agriculture Organization of the UN (FAO)**, Italy (Dr. Aslihan Arslan, Natural Resource Economist, Agricultural Development Economics Division)
- **United Nations Economic and Social Commission for Western Asia (ESCWA)**, Lebanon (Prof. Dr. Yasser Dessouky, Renewable Energy Expert in the ESCWA)
- **Regional Center for Renewable Energy and Energy Efficiency (RCREEE)**, Egypt (Tareq Emtairah, Hind Il Idrissi)
- **United Nations Development Programme (UNDP)**, Armenia (Dr. Diana Harutyunyan, Energy Efficiency and Climate Change Program Coordinator)