



System Dynamic Modeling

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The Millennium Institute

- **MI was established in 1983 to promote holistic, long-term strategic planning based on lessons learned in Global 2000**
- **MI's Vision is to help countries and people reduce poverty, increase sustainable growth, and improve living standards**
- **MI's Mission is to achieve this by**
 - **Providing countries tools for better strategic decision making**
 - **Helping them convert strategic visions into achievable sustainable development plans with the tools**
 - **Building capacity in countries to use the tools so they can achieve their development goals sooner**
 - **Incorporating stakeholders' concerns into the process**

MI's activities



**Sustainable strategic development, customized models, and reports
Assisted many countries**

- CC Mitigation and Adaptation
- Energy:
- Poverty, MDGs, Malaria, HIV/AIDS
- Natural disasters and External shocks
- Sustainable Development
- Business
- Post conflict / peace and security
- Current activities
- Current activities

The development challenges



- **Manage energy and natural resources to assure the sustainability of the ecological foundation that support all life;**
- **Assure for the long term food and nutrition security;**
- **Enable social structures and governance to function equitably**
- **Provide social and environmental services as well economic growth to reduce poverty**
- **Take account of the vital interactions among the Economic, Environmental, and Social factors**
- **Adapt to climate change and protecting the environment requires serious and urgent changes in our economic and social activities**



How best address these challenges

- **Understand real relations in the situations we face, within and beyond economics**
- **Take account of interactions and feedback loops across different sectors and from different policies**
- **Manage depletion of natural capital and allocate resources to investment in human and physical capital**
- **Take account of longer term effects and lags**
- **Examine the results of different assumptions, investments, and policies to make better decisions**
- **Best done at country level, where the key policy decisions are made, but in the context of the global commons**



Key factors to take into account

- **Economic and social externalities**
 - Impacts of depletion of resources – forests, fish, minerals
 - Impacts of waste and pollution on health and resources
 - Impacts of urban development on land and water
- **Public Goods and the Global Commons**
 - Climate change impacts and clean air
 - Water scarcity
 - Access to resources and biosystem protection
- **Assuring wellbeing of all humans and bio-systems**
- **How to keep track of all these factors?**



Limitation of usual tools

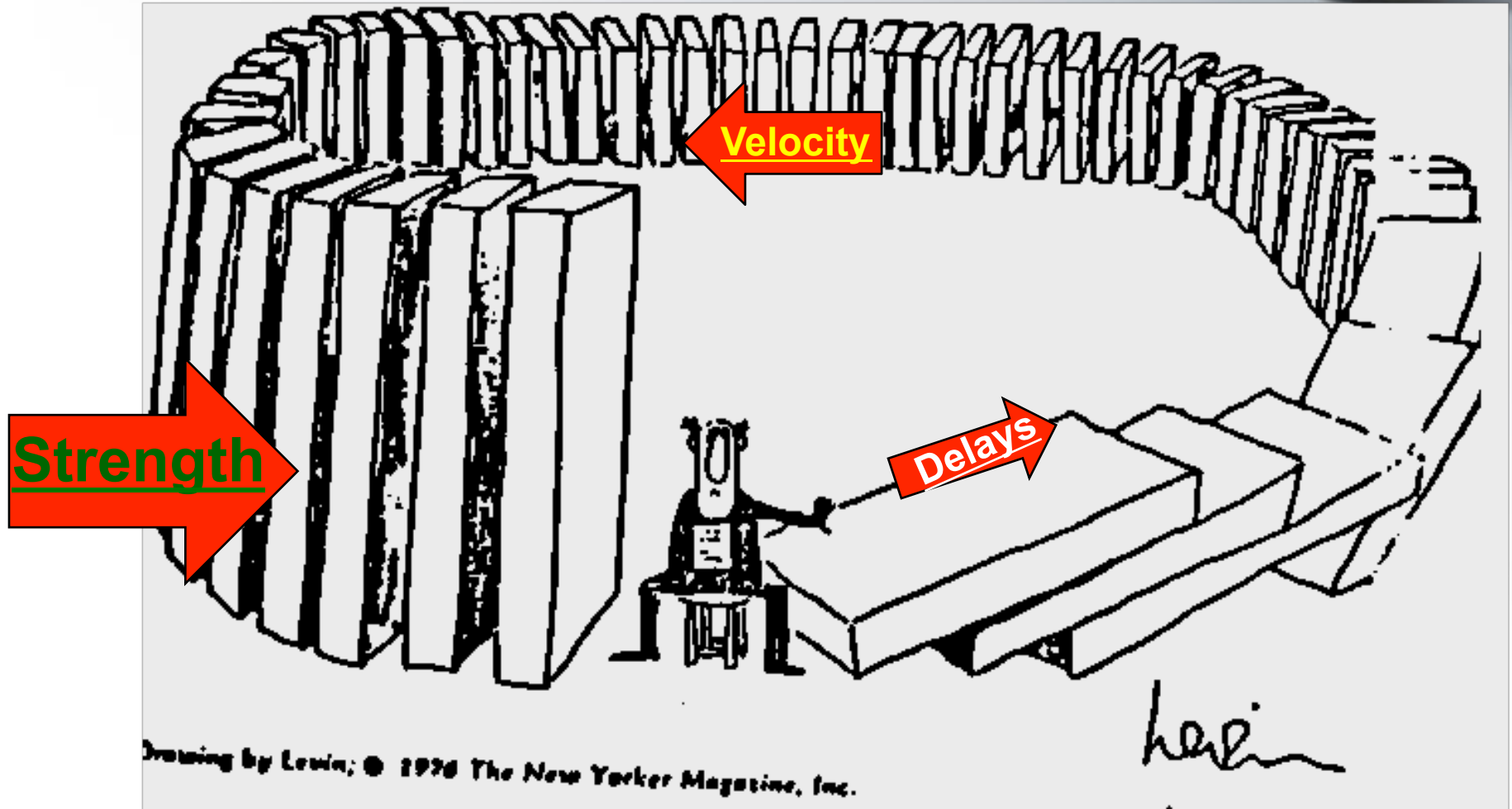
- **Conventional models focus on sector specific and beneficial economic results, assuming markets work**
- **Normal economic models**
 - Accounting models
 - Econometric models
 - Simultaneous solution models: CGEs
- **They typically take a short term or comparative static view without attention to the environment or social externalities or equity and the Gini coefficient**
- **Environmental models provide information about climate change and other environmental factors, but few economic and social impacts**
- **A more comprehensive approach is needed**

A complementary, “Systemic and integrated” approach



- It can take account of the relations among economic, social, and environmental issues comprehensively
 - Economic activities affect society and the environment (ie, Pollution, GHG emissions, etc.)
 - Social activities affect the economy and environment (ie, Migration, deforestation, etc.)
 - Environmental factors affect the economy and society (ie, Soil erosion, heat waves, floods, etc.)
- It can incorporate any factor considered important
- It illustrates how activities in any sector can effect other sectors: direct and indirect -- good and bad
- It takes account of lags before impacts are evident, which many be many years

...and avoid unintended consequences



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The Threshold 21 model

- **System dynamics methodology**
 - Based on existing sector analyses
 - Reflects observed real world relations
 - Analyzes cross-sector links and feedback loops
- **Composed of three main dimensions**
 - Economic -- SAM, key market balances, and production
 - Social -- dynamics in population, health, HIV/AIDS, education
 - Environmental -- area specific issues and information

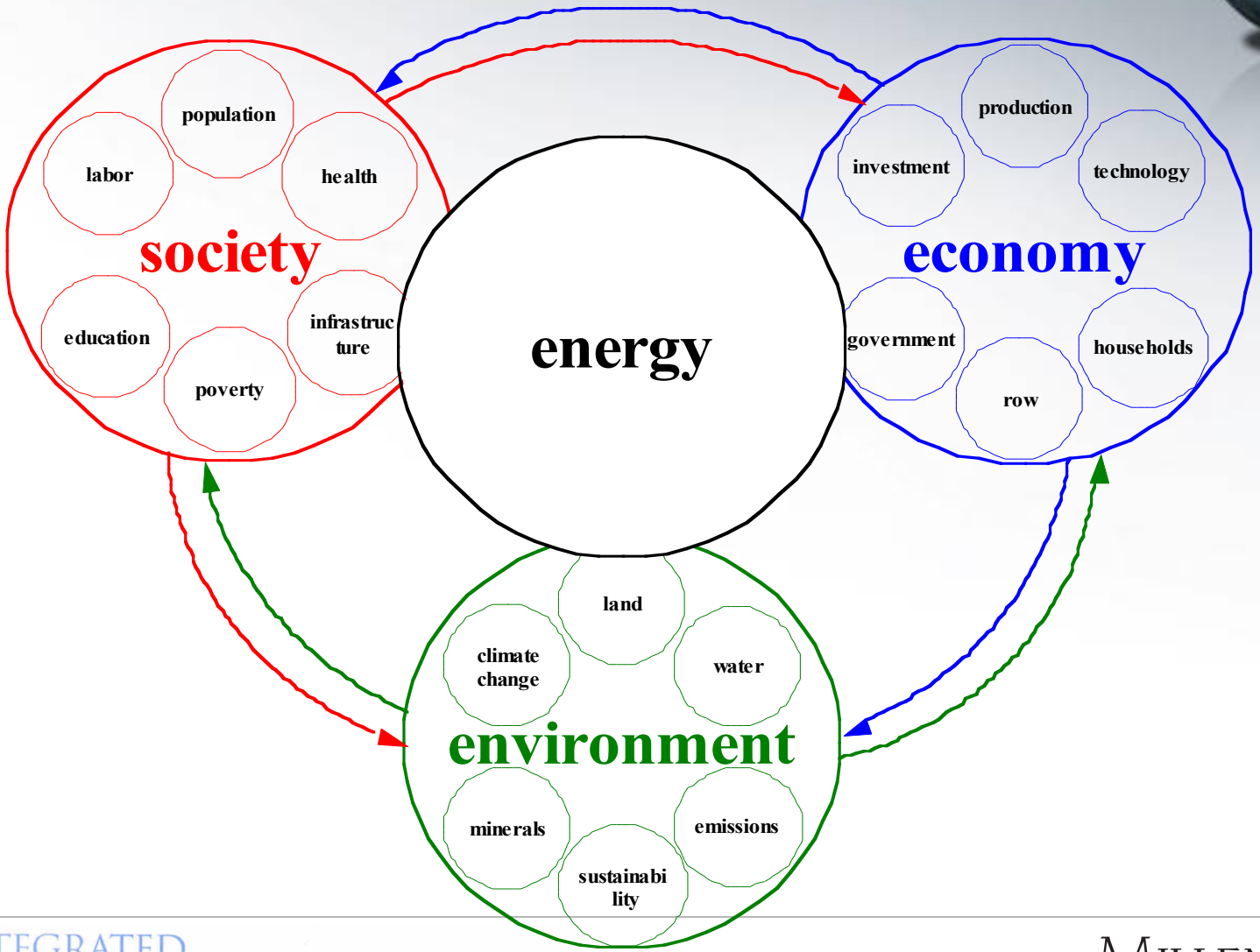


The Threshold 21 model cont'd

- Adapted to priority goals and vision for each individual country based on its own data, structure, patterns of activity and needs
- Highlights inter-sectoral feedbacks
- Tracks progress on MDGs (soon the SDGs) and other indicators
- Calibrated against history to provide reality checks
- Generates multiple medium-to-long-term scenarios
- Transparent and easy to use

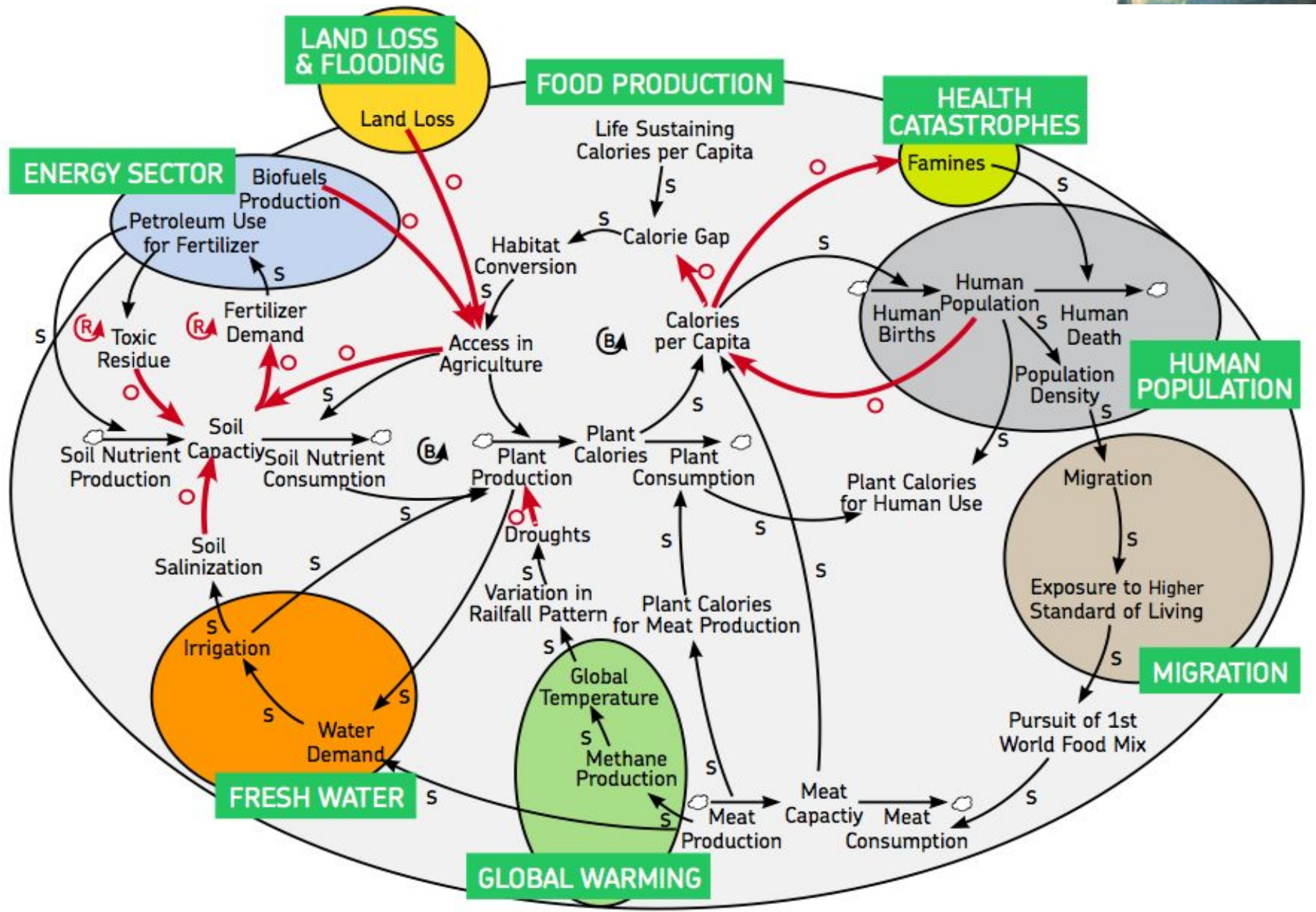


The basic T21 structure





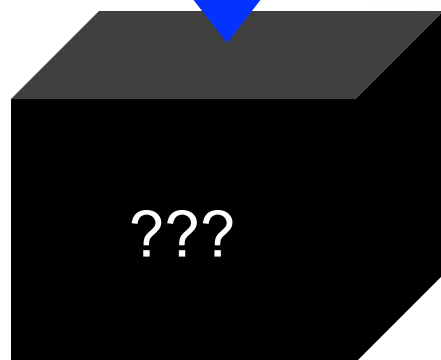
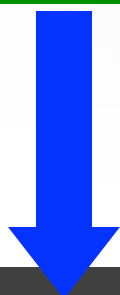
Thinking in system: in agriculture....



Transparency



Input



Output



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Work on CC Adaptation



- **Include impacts of changes in temperature and rainfall patterns**
- **Assess impacts on water, energy, health and food security**
- **Illustrate effects of different coping policies to address these issues**
- **Builds local capacity to deal with these issues over the longer term (changing conditions)**



...some results (UNEP GER Report – 2011), Investing 0.1% or 0.16% of total GDP (\$83-\$141 Billion) / year

Year		2011	2050
Scenario	Unit	Baseline	Green  BAU
Ag production	Bn US\$/Yr	1,921	2,852  2,559
Crops	Bn US\$/Yr	629	996  913
Employment	M People	1,075	1,703  1,656
Soil quality	Dmnl	0.92	1.03  0.73
Ag water use	KM3/Yr	3,389	3,207  4,878
Harvested land	Bn ha	1.20	1.26  1.31
Deforestation	M ha/Yr	16	7  15
Calories p/c/day for consumption	Kcal/C/D	2,081	2.524  2.476

You cannot solve the problem with the same kind of thinking that created the problem. *Albert Einstein*



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Thank you

