

Intro to System Dynamics and the World3 Model

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New Global Agenda course
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Outline

- Definition and history of System Dynamics (SD)
- Intro to the “process”
- Elements of SD models
- Dynamic structures of systems
- Limits to Growth and World3 Model

Definition

- “System dynamics is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems.”
 - System Dynamics Society (www.systemdynamics.org)

Quick History

- Developed in 1950s by Jay Forrester at Sloan
 - Industrial Dynamics (1961)
 - Urban Dynamics (1969)
 - World Dynamics (1971)
 - Limits to Growth (1972)

Quick History (2)

- corporate planning and policy design
- public management and policy
- biological and medical modeling
- energy and the environment
- theory development in the natural and social sciences
- dynamic decision making
- complex nonlinear dynamics

Benefits

- Collaborative exploration of mental models
- Explore dynamic complexity, which is hard to understand
- System structure is often overlooked

General SD Process

- Articulate the problem
- List key variables or factors
 - Outcomes
 - Decisions
- Sketch behavior (explore mental model)
- Determine time horizon
- Sketch loops, stocks, flows (iterate)

Example: Bank account

- Problem: How is my account growing?
- Variables: ??
- Sketch behavior of variables
- Time horizon
- Draw diagram

Dynamic behaviors

- Reinforcing
- Balancing
- S-shaped
- Others?

Limits to Growth

- “Over-shoot-and-collapse” because of delays in the structure of the system
- Controversial - 1970s doomsayers

- Latest edition is *Limits to Growth: 30-year update*

World3 Model

- Demographics (fertility and population)
- Pollution
- Non-renewable resources
- Food production
- Land-use
- Industrial and Service sector outputs
- Overall “welfare”

More Info

- Sloan courses (15.874, 15.875)
- Contact System Dynamics Research Group (<http://mitsloan.mit.edu/omg/>)