Business Dynamics Chapter 3: The Modeling Process

1. Model and Modeling
   - A model is a simplification of the reality; you have to exclude something to make it useful.
   - Modeling always starts from a purpose, and models are built to enhance learning toward that purpose.
     i. 空調系統: 追求舒適 vs. 追求能源效率
     ii. 汽車: 省油 vs. 扭力
2. Qualities are designed-in
   - System designers are more important than system pilots.
   - Organizations should depend on good organizational designs that can be managed by ordinary people, instead of depending on good executives.
3. Modelers' role and ethics: Modeling is a mind-changing (learning) process
   - Modeler should shift its role from a solution finder to a dissolution designer
   - Modelers work in a value-bound politics-rich context
   - A model's mission is to generate impacts on those who lead to solve the problem. Let the modeling process changes your and the clients' minds.
   - Plato is dear to me, but dearer still is truth. Get a new customer if necessary.
4. Modeling as a Learning Process
   - Iterating through the 5 steps:
     i. Problem Articulation
        - This is the most important step
        - Model the problem, not the system

        Problem = desired state – current state

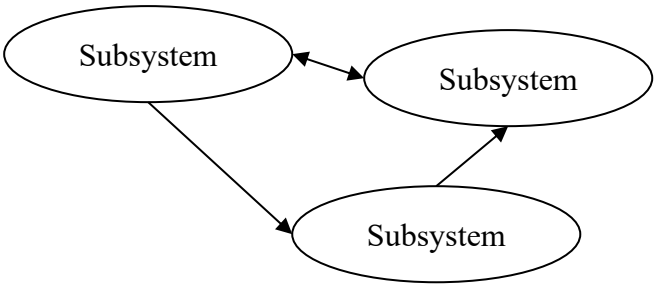
        Desired state = f(purpose)
        - Clarify the purpose → determine the system boundary → explore system structure
        - Characterize the problem with **Reference Modes** (various data showing the "behavior" of the problem over time)
        - Decide a proper **Time Horizon:** minimally several times longer than the longest time delay in the system

     ii. Formulating Dynamic Hypothesis (working theory of how the problem arose)
        - Focus more on capturing important feedback loops than the details of specific component
        - Model boundary Chart

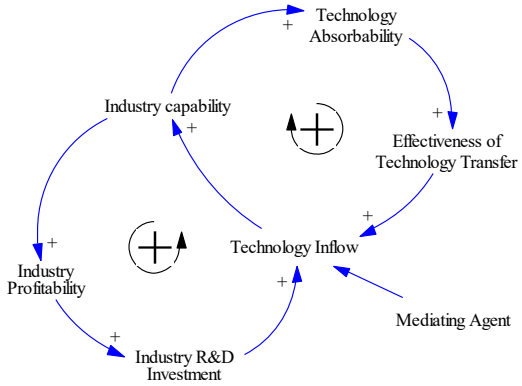
Relevant / Controllable	Y		N
Y	Endogenous		Exclude
N	Exogenous		Exclude

Endogenous Factors	Exogenous Factors	Excluded Factors
Factor 1 Factor 2		

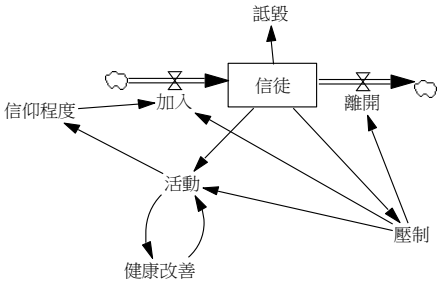
- Subsystem Diagram (high level design: level of aggregation)



- Causal Loop Diagram (logical design: causal relations)



- Stock and Flow Diagram (physical design: relationship formulation)



- Policy Structure Diagram

  Similar to Stock and flow diagram, but focus on the information flows to or from the rate and related variable related to specific decision

iii. Formulating a Formal Model for Simulation (implementation)

- Actually specify the equations and parameters of the model
- Ground the equations on facts or explicit assumptions

iv. Testing

- Face validity (dimensional consistency, feasibility of scale, etc.)
- Structure validity (structure derived from facts or mental models)
- Behavior validity (model behavior mimics the real world/historical pattern)
- Policy Validity (Policy derived from the model works in the real world)

v. Policy Design and Evaluation

- Design and test the model in various meaningful scenarios, thus to gain insights and understandings toward the problem