Things Fall Apart

Some thoughts on complexity, supply chains, infrastructure & collapse dynamics

David Korowicz
Feasta
The Foundation for the Economics of Sustainability

ASPO/The Oil Drum Peak Summit
Alcatraz, Italy
28th June 2009
Turning and turning in the widening gyre
The falcon cannot hear the falconer:
Things fall apart: the centre cannot hold:
Mere anarchy is loosed upon the world

from The Second Comming
W B Yeats
16 Thousand Years: What's Changed?

Lascaux cave complex SW France
Thermodynamics of Civilisation
Far from equilibrium thermodynamics & Bernard cells

- Flow of free energy allows structure to form.
- Locally, entropy is reduced. Globally entropy increases.
- Thermodynamic properties: phase transitions; MEP; sensitive dependence on initial conditions

(Pictures: www.intothecool.com)
Energy Rate Density: A Cosmic View

- Trend of greater complexity with evolving sources of free energy
- Complexity is not a goal—teleological explanations not valid

Resources used in manufacturing process

- Growing complexity of modern processes.
- Semiconductor technologies most obvious example.
- 2g 32MB DRAM chip requires 1700 g input. Silicon wafers from quartz uses 160 times energy for normal silicon.  
Complexity & the Global Economy

Complexity
Number and depth of interactions; product number; product complexity; institutional complexity

Self-Organising
The Blind Watchmaker; local control - globally uncontrollable

Supply-Chains
Resource allocation and distribution; information processing; & infrastructure maintenance

Growth Tendency in a Finite World
Problem solving is resource intensive; I=PAxT
Evolution of Complexity

- Problem solving-constrained by social, cultural attitudes & structures, implied infrastructure, and resource availability

- Easiest problems/ lowest cost first

- Sub-systems become more interdependent: Can help to manage risk

- As new technologies/ business models emerge, adoption and spread through wider networks dependent upon efficiencies they provide, lower costs, new markets

- New technology and system to which it is introduced co-adapt & co-evolve

- Efficiency gain by letting individual parts of system share transaction costs by integrating common platforms such as IT networks, financial systems, and supply chains

- Growing complexity provides basis for solving more complex problems

- Declining Marginal Returns: Civilisation; EROEI; Material Resources; R&D; Agricultural Productivity

- Lost resilience, can no longer adapt to perturbations (Tainter)
Analogy: An adaptive landscape for a choice, at a time

Implied infrastructure
Supply-Chains & Infrastructure
More complex things-longer/more complex supply-chains
- More un-substitutable components
- More energy/resource dependent
- More implied infrastructure dependent
Infrastructure

Story

- Deep Integration
- Tightly Coupled
- Each part of economy cross-subsidises every other part
- Economies of scale
- Constructed by a growth economy
- Up-grading *is* maintenance
Collapse

A sudden decrease in complexity

OR

A phase transition, driven by a series of mutually re-enforcing positive feedbacks
Debt & Opaque money

- Monetary System Collapse
- Deflation/ Inflation/ Hyperinflation
- Exchange rate uncertainty
- Uncertainty (thermodynamics)
- Balance of trade
- Investment

Annual investment accruing 4% interest per annum. In a growing economy, that's fine. In a contracting economy, principle+interest owed begins to swamp the productive economy.
Supply-Chain Creeping Collapse

Self-re-enforcing interactions between:

- Declining discretionary income
- Inability to pay for goods/ inability to run trade deficits
- Opaque money
- Higher input costs
- Plant degradation
- Infrastructure degradation
- Dis-economies of Scale

- Creeping Collapse re-enforces creeping collapse
Dis-Economies of Scale

Dependent Economy

General Economy

Food

Political instability

Unknowns

Fewer goods bought

Rising goods cost

Declining Discretionary Income
Infrastructure Creeping Collapse

Tightly Coupled
Complex resource intensive supply chains
Expensive to maintain
Highly cross-subsidised
Economic stress
Supply-chain creeping collapse
Short-component lifetimes
Complexity and interconnected make cascading failure hard to predict
Scenario: Fast Supply Chain-Collapse

- ASPO/Oil Drumers ignored/dumb
- Sovereign/Debt defaults
- Energy/food prices inhibit growth
- Sovereign/Debt defaults
- Maybe they are correct?
- Herd begins to PANIC!
- Bank Assets collapse
- Debt cannot be repaid
- All banks insolvent
- Bastards are collapsing the economy!
- Supply-chain collapse
- All hell breaks loose!
Conclusions

- Fast Collapse
- Massive Dis-orientation
- Emergency Measures