CE 9800:
Sustainability in Civil Engineering

XI. Implementation

Term project report

- Suggested outline
  - Abstract: Tell me what **you** did; include key quantitative results, message to public/policymakers
  - Introduction (can be fairly short)
  - Methods
  - Results
  - Discussion
  - Summary of dissemination activity (include copy of material and/or links in appendix)
  - Conclusion
- Deadline: May 17 (including dissemination), on Blackboard; 15-minute presentations May 16

Documenting your contribution

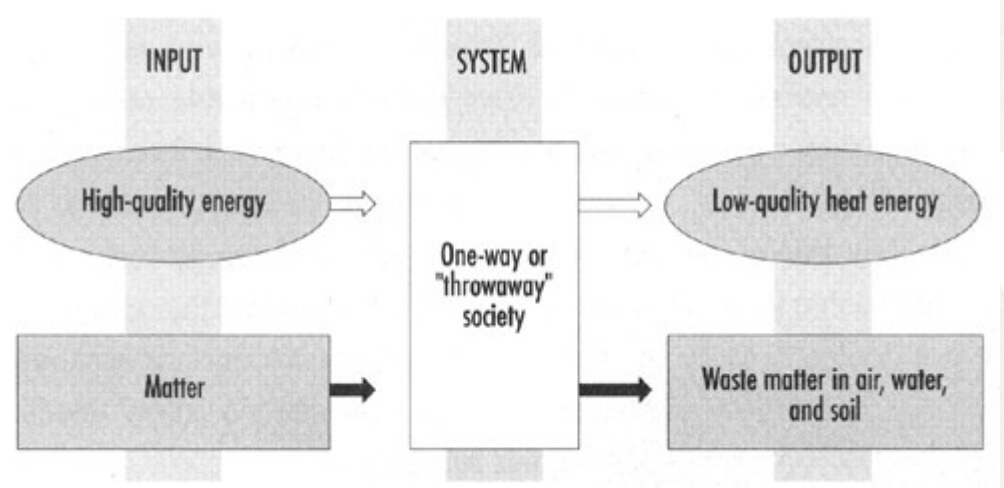
- **You** have something valuable to add to dialogues on sustainability! The purpose of the project is to allow you to demonstrate this.
- Make it clear (even in the abstract) what **you** did
  - If doing an original analysis: summarize what's been done before; describe your assumptions; highlight your main findings
  - If reviewing previous work: *critically* evaluate the strengths, weaknesses, different assumptions of each relevant study; what are the areas of agreement and argument?; what's the take-home message?

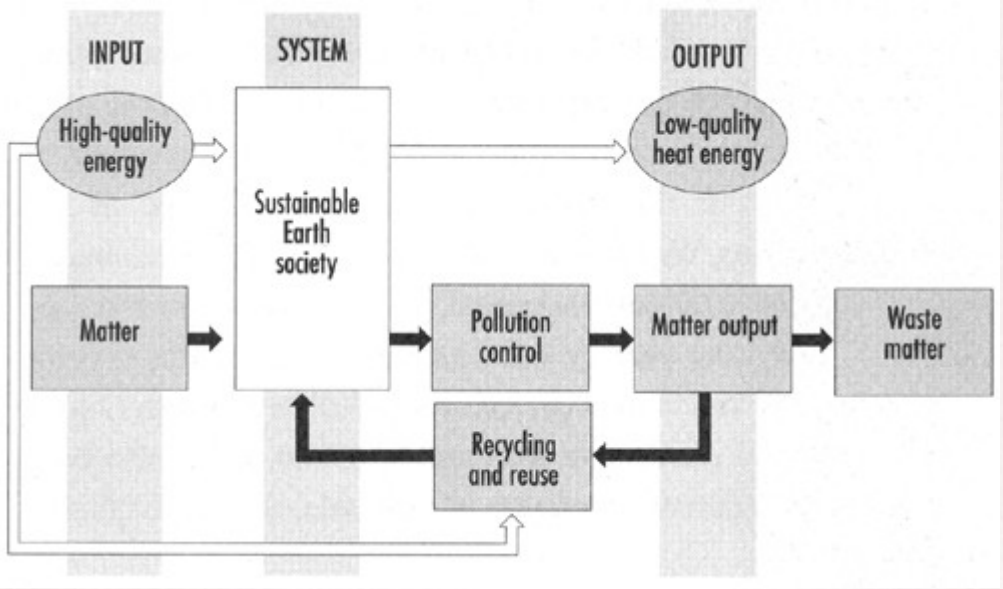
What is sustainability?

1. eliminate the progressive buildup of substances extracted from the Earth's crust (for example, heavy metals and fossil fuels)
2. eliminate the progressive buildup of chemicals and compounds produced by society (for example, dioxins, PCBs, and DDT)
3. eliminate the progressive physical degradation and destruction of nature and natural processes (for example, over harvesting forests and paving over critical wildlife habitat); and
4. eliminate conditions that undermine people's capacity to meet their basic human needs (for example, unsafe working conditions and not enough pay to live on).

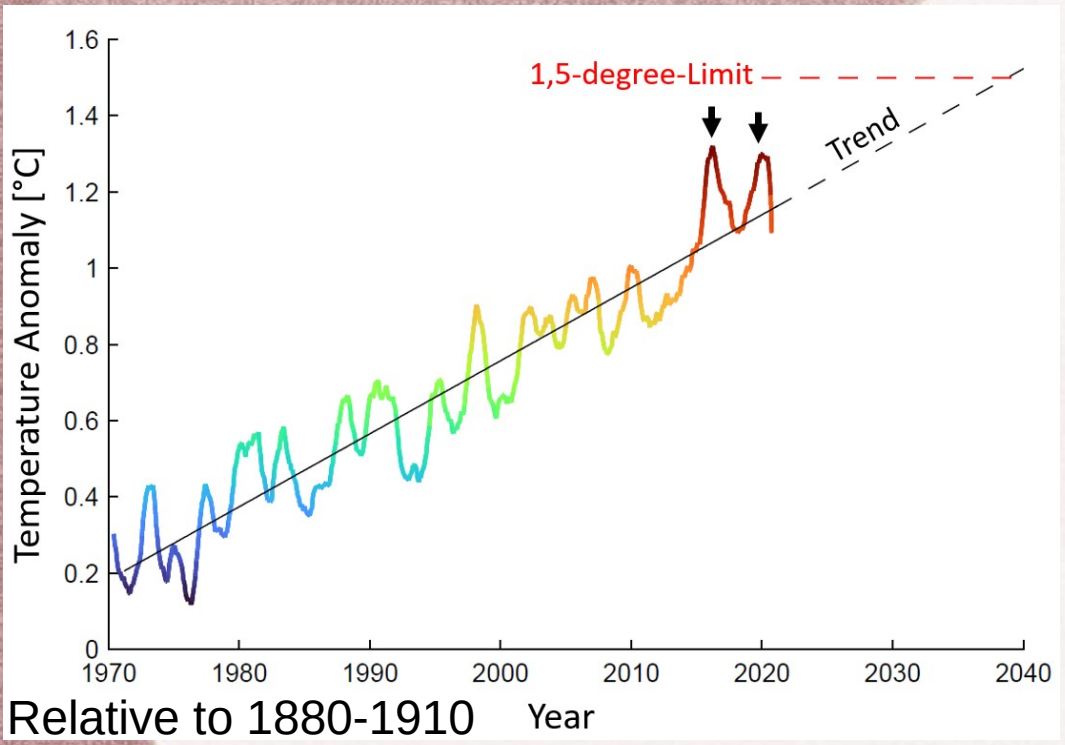
[condensed from Natural Step]

Closing loops



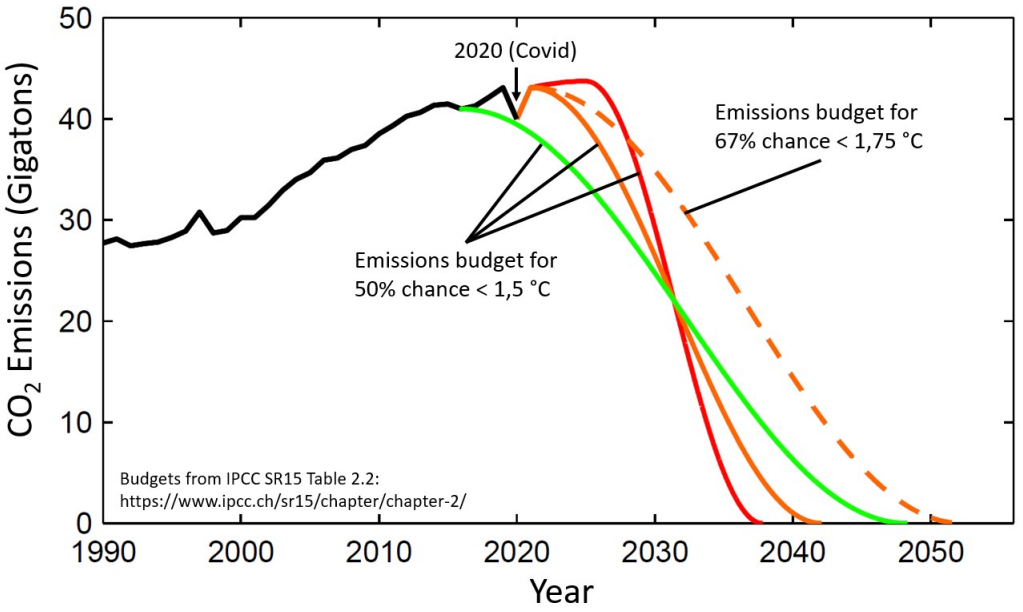


Short timelines



Stefan Rahmstorf, RealClimate blog (2021)

Global emissions compatible with the Paris Accord



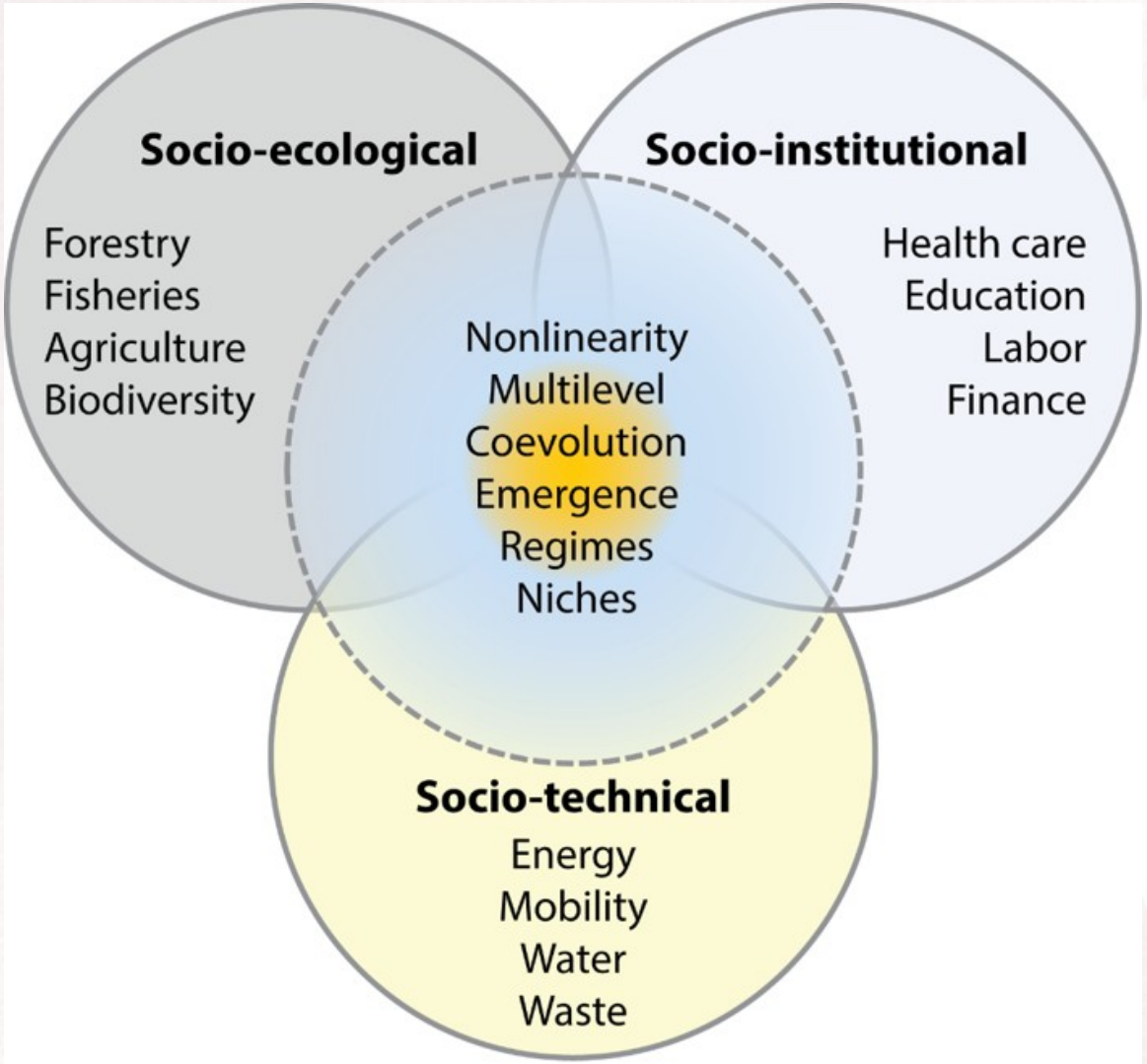
Considerations

- As we've discussed, there are technical methods for maintaining a fairly high standard of living for all sustainably
- We *will* be changing, since current infrastructure cannot be maintained
- Can we get there more quickly and comprehensively, given vested interests and sheer inertia?
- This broadly involves politics, i.e. how organized groups of people come to decisions

Complex sociotechnical systems

- Examples: transportation, food, health care, ...
- Optimizing subsystems not always best for whole
  - Different feedbacks, time scales, emergent behaviors
  - Many stakeholders, diverse goals
  - Bounded rationality
  - Evolved, never fully designed
  - Good enough, not most efficient

System interconnections



Loorbach D, et al. 2017.
Annu. Rev. Environ. Resour. 42:599–626

Changing the system

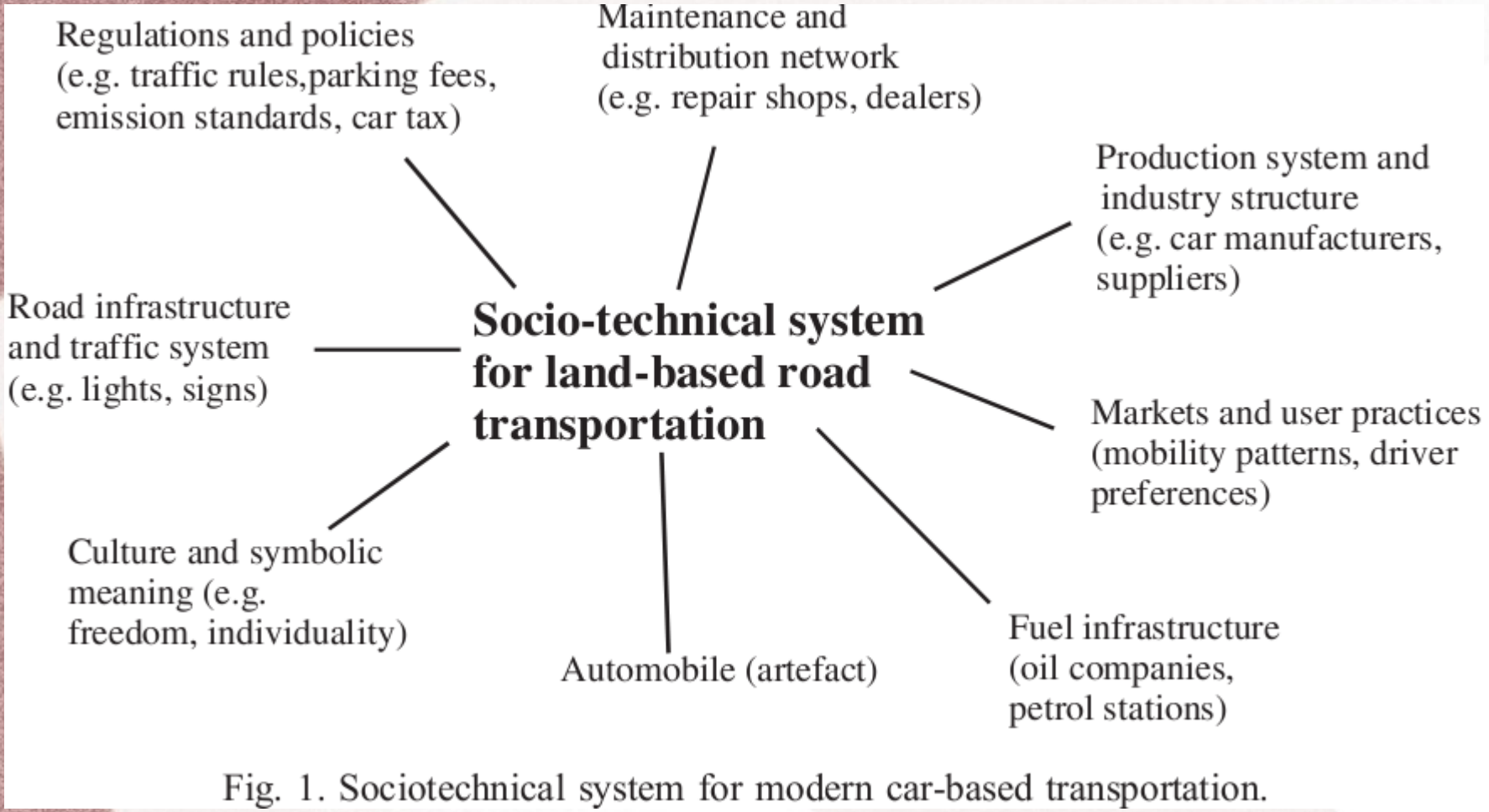


Fig. 1. Sociotechnical system for modern car-based transportation.

F.W. Geels, *Technological Forecasting & Social Change* 72:681 (2005)

Car culture an example of an infrastructure *system*, with technical, economic, cultural components reinforcing each other

What happens when a system can't continue?

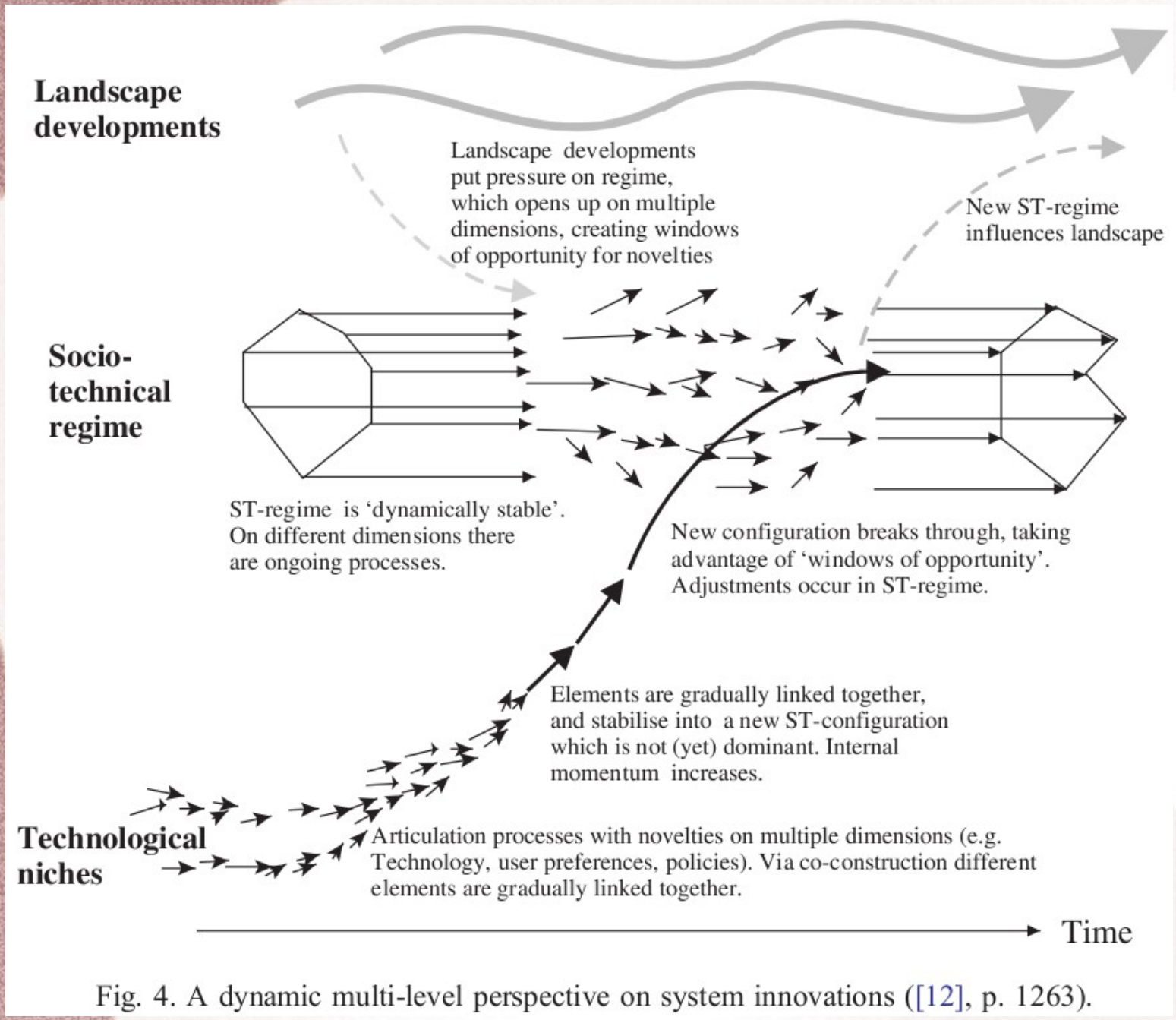


Fig. 4. A dynamic multi-level perspective on system innovations ([12], p. 1263).

How does new technology fit in?

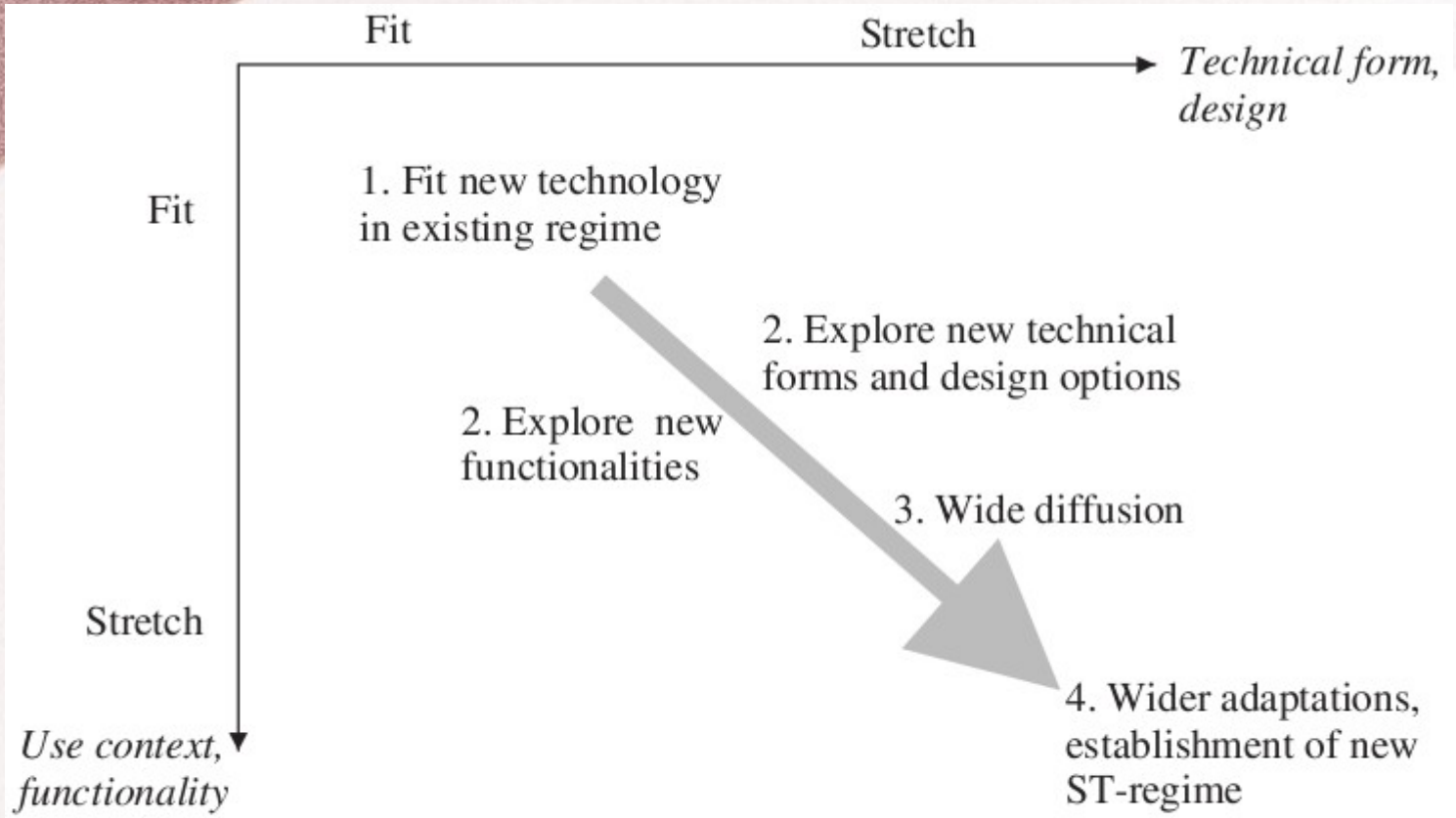
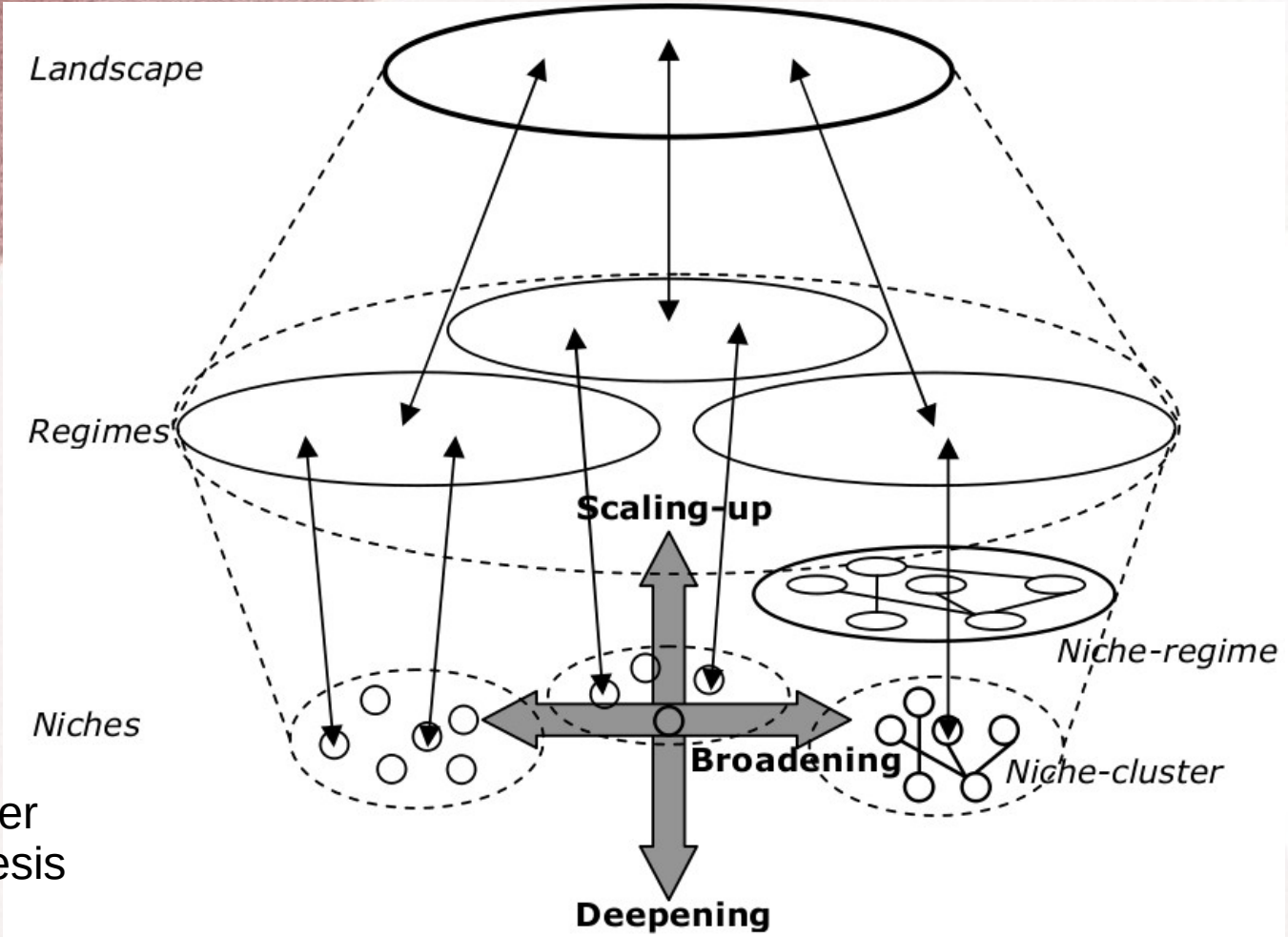


Fig. 7. Fit–stretch pattern in the co-evolution of form and function.

- Examples: cellphones, organic food

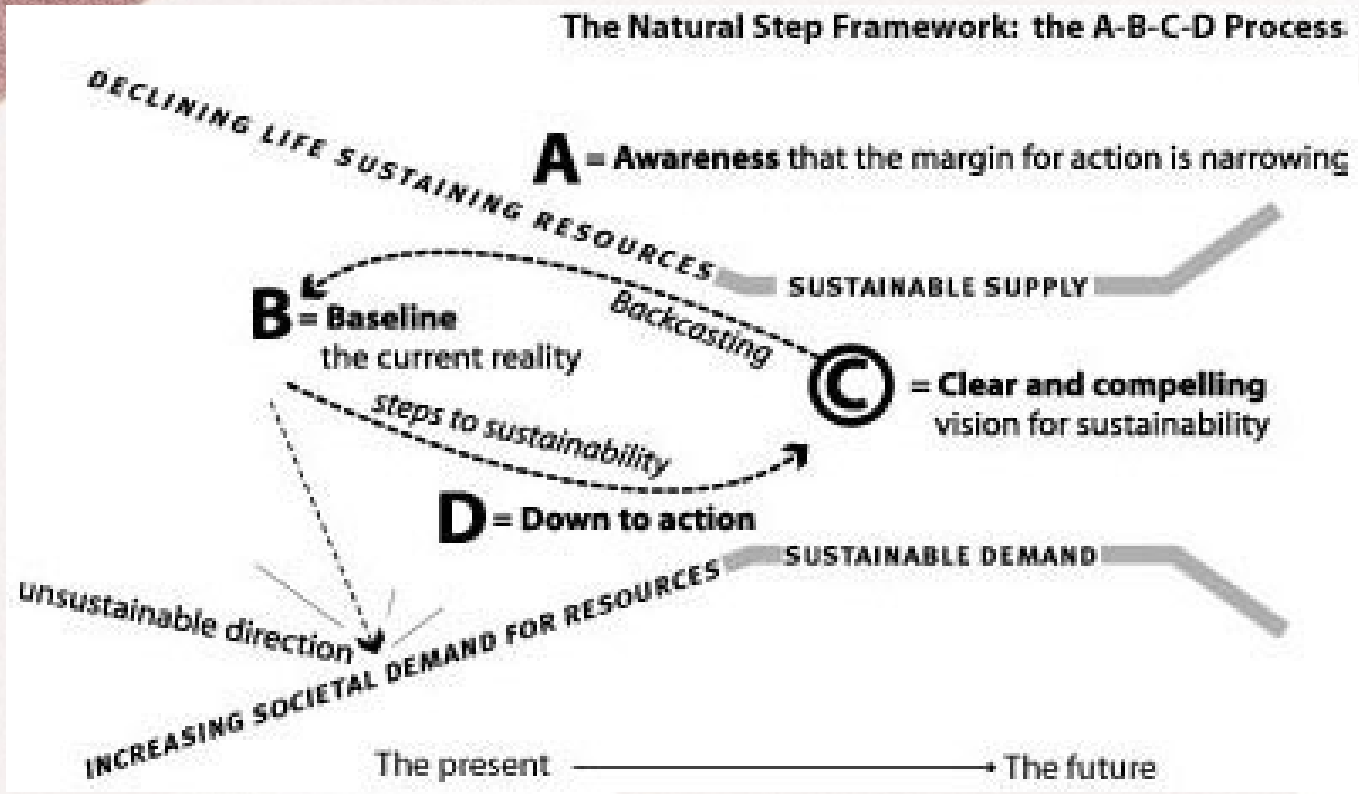
Implications for transition management



Suzanne van der Bosch, PhD thesis (2010)

- Work out new practices among motivated early adopters
- Expand experiments to larger scale (media, city/state govt.)
- Reach out toward the mainstream (societies, codes)
- Example: energy-efficient building

Backcasting vs. forecasting



- Forecasting: extrapolate current trends – “growth will continue” or “we're doomed”
- Backcasting: figure how how we can end up where we want

The Transition Movement: an example of grassroots organizing

- Started in UK, 2005, hundreds of local groups; transitionnetwork.org
- Local groups carry out programs under the Transition Town label, such as food growing and marketing (cf. community gardens in NYC)
- Involves community members and local politicians in creating and implementing plans to move “from oil dependency to local resilience”; aim is to present it “as a common journey, as a collective adventure, as something positive”

Backcasting in Transition

- The School Reunion exercise
  - Groups decide what will have happened in different character's lives, based on cue cards
  - Group delegates role-play four people at a 20-year school reunion
  - Work back to what should be done now
  - “Visions of the future are the first step to a concrete plan for how to make that future a reality, otherwise they are a waste of time, and merely fantasy.”

Reaching the concerned public with actionable information on product consequences and alternatives

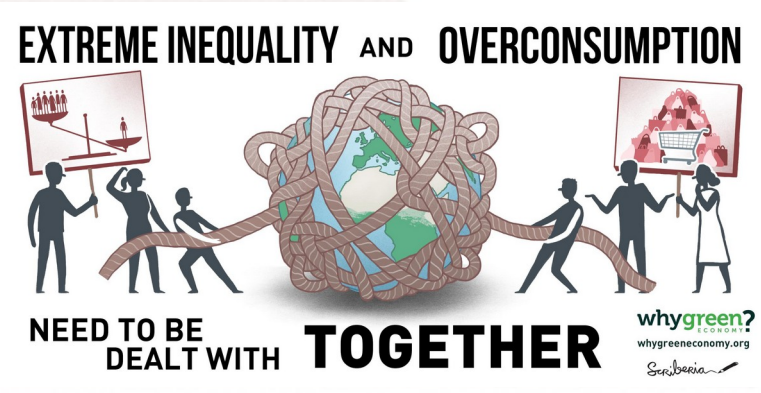
- The “footprint” concept has proven to be a vivid way of presenting LCA results
- Ratings: e.g. GoodGuide.com makes available information on the impacts of individual products (scan a bar code); ratings “combine product- and company-level information to characterize a product's health, environmental and social impacts” on a 0-10 scale
- Matching of producers to consumers: NYCMEDP, CSA

Politics

- Policy may shift gradually, but an insistent vocal minority helps a lot
- Leading political movements is not something most engineers are good at or like
- Consider sharing technical expertise thru consulting, evaluating political platforms, speaking to politically active groups, as well as to existing clients and projects

Inequality is an obstacle to loop closing

- The competition for conspicuous consumption means the richest might ignore policies that aim to get them to reduce their ecological footprint
- Some of the richest might be more disconnected from the reality of the ecological crisis
- The richest are likely to have more resources to adapt to and insulate themselves from the impact of climate change
- Environmental taxes may have less effect on the richest because they can afford to pay to continue polluting



Money

Financing and Other Barriers to Investment

Financing issues (in green) underline a number of the barriers to investment frequently reported in the literature and in stakeholder surveys.

3

- An oft-posited obstacle
- Unequally distributed
  - Speaks undemocratically

Modern monetary theory

NEWS

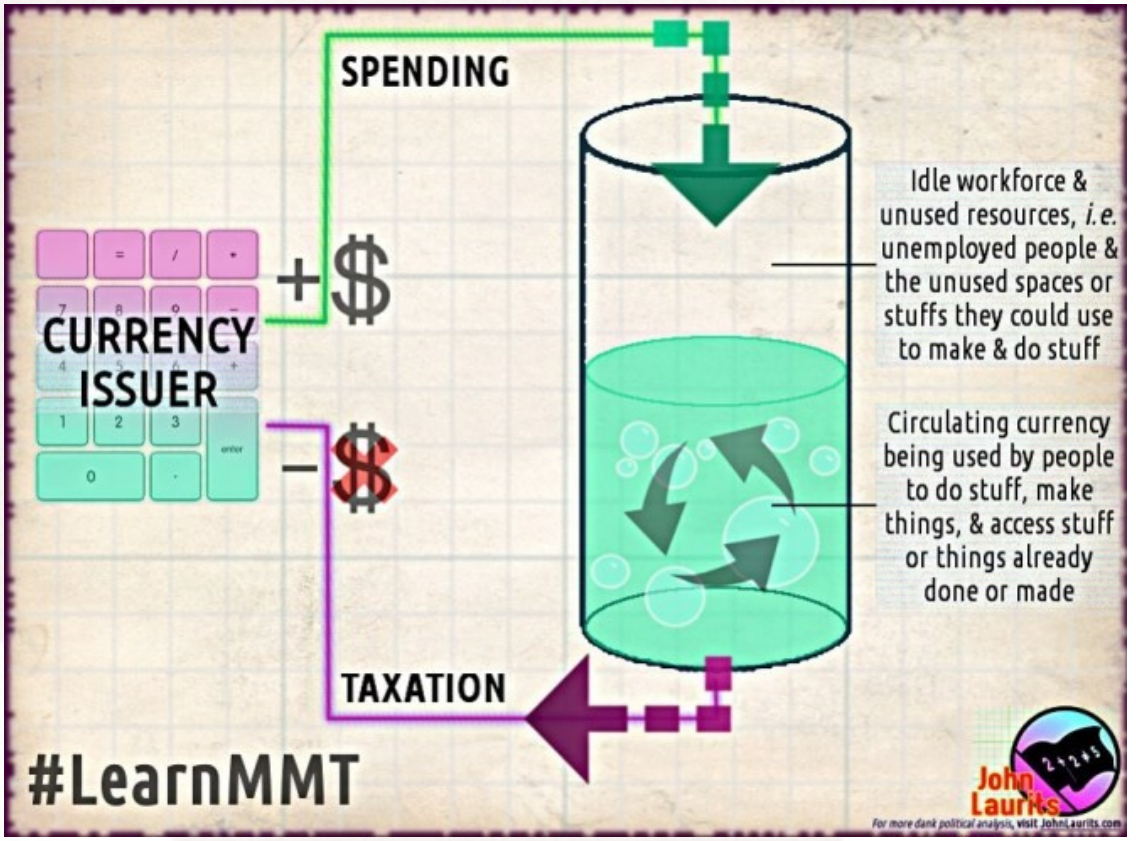
U.S. Economy Grinds To Halt As Nation Realizes Money Just A Symbolic, Mutually Shared Illusion

2/16/10 5:00pm • SEE MORE: TREASURE

WASHINGTON—The U.S. economy ceased to function this week after unexpected existential remarks by Federal Reserve chairman Ben Bernanke shocked Americans into realizing that money is, in fact, just a meaningless and intangible social construct.

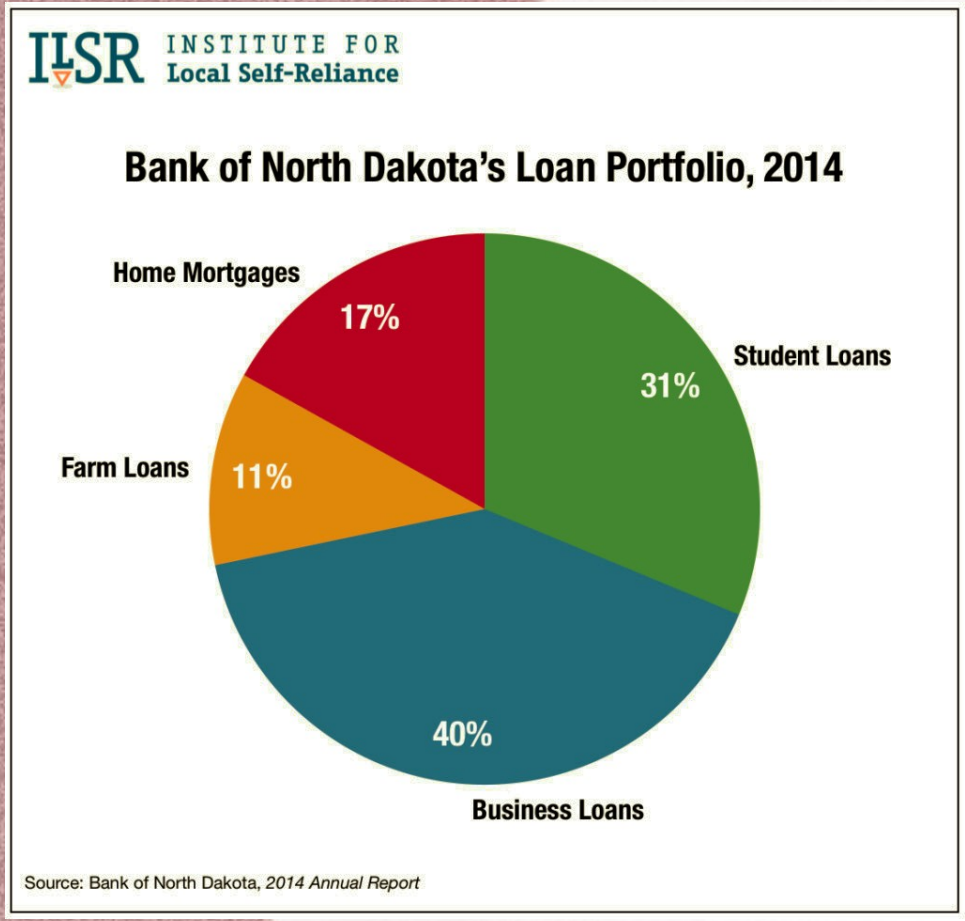
What began as a routine report before the Senate Finance Committee Tuesday ended with Bernanke passionately disavowing the entire concept of currency, and negating in an instant the very foundation of the world's largest economy.

Share Tweet



- Justifies government (and potentially the democratic public interest) creating and using money, not just banks (owned by a wealthy minority)
- Cf. the experience of the New Deal

State and local banks



- Bank of North Dakota: founded in 1919 by the Non-Partisan League, generates ~$100M/y profit that goes to state
- Provides money toward loans by private banks; can respond to emergencies like flooding

The Green New Deal in cities

- The New York Climate Mobilization Act (2019): Require large buildings to upgrade energy performance (~40% by 2030); require green roofs or solar for new buildings
- Climate Smart San José: all new residential buildings meet Zero Net Carbon standards by 2020 and all new commercial buildings be ZNC by 2030
  - California Energy Commission: a “growing consensus that building electrification is the most viable and predictable path to zero-emission buildings.”