



Pursuing Sustainability: A framework for Linking Science and Practice

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by

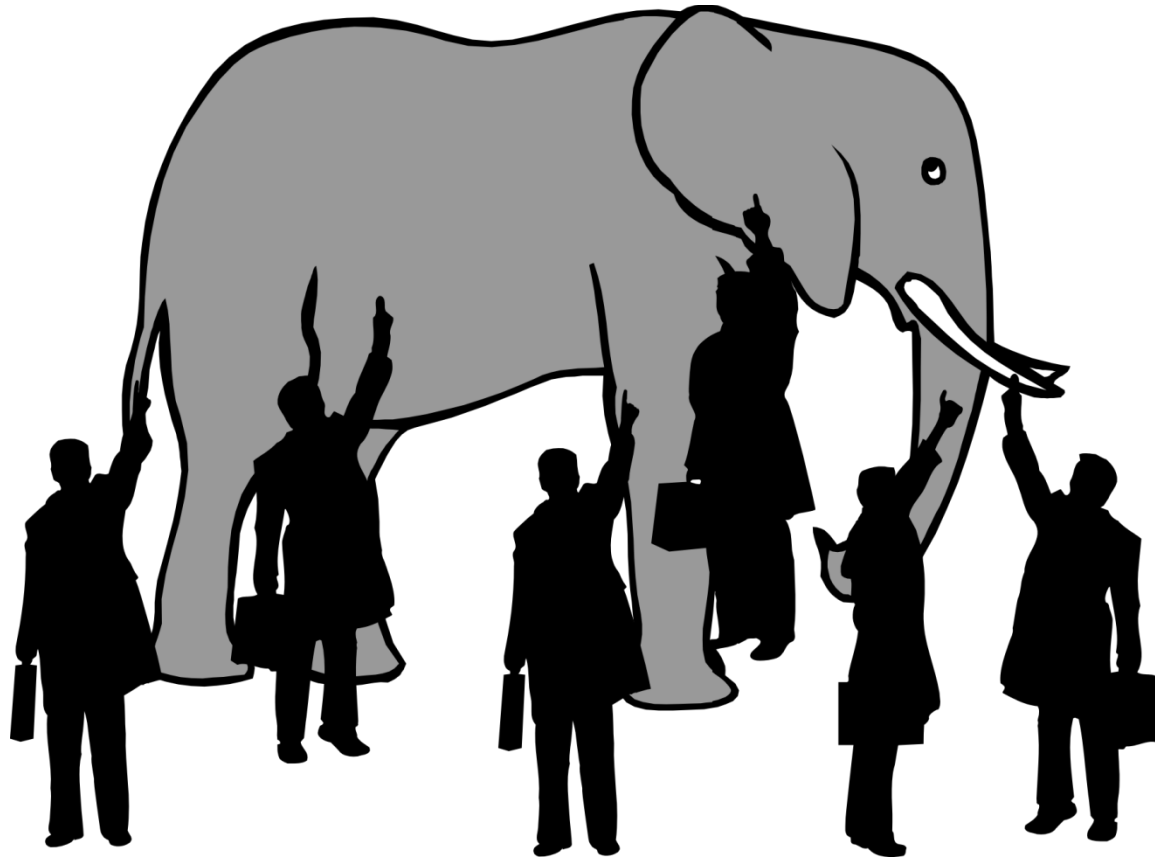
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Why a framework?





Progress in tackling Schellnhuber's *Grand Challenges of Sustainability Science*

1. Normative challenges

* *Inclusive human well-being* that does not decline should be the overall goal of sustainable development

2. Analytic challenges

* *Stocks of capital assets* are the ultimate determinants, state variables, and metrics of sustainable development

3. Operational challenges

* *Sustainability transitions* needed in how assets are harnessed in essential production-consumption systems

4. Strategic challenges

* *Informed agitation* needed for sustainability transitions

1) Normative Challenges: Goals for Sustainable Development?



“Humanity has the ability to make development sustainable:

To ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.”



Proliferation of normative goals...

- Examples...
 - Amartya Sen’s “Human freedoms / capabilities”
 - OECD’s individual “Better life” constituents
 - UN’s new 17 “International SDGs...”
- Common ground?
 - Developing *people*, not (just) protecting environment
 - Concern for equity, justice, future generations
 - Need for fit to local contexts

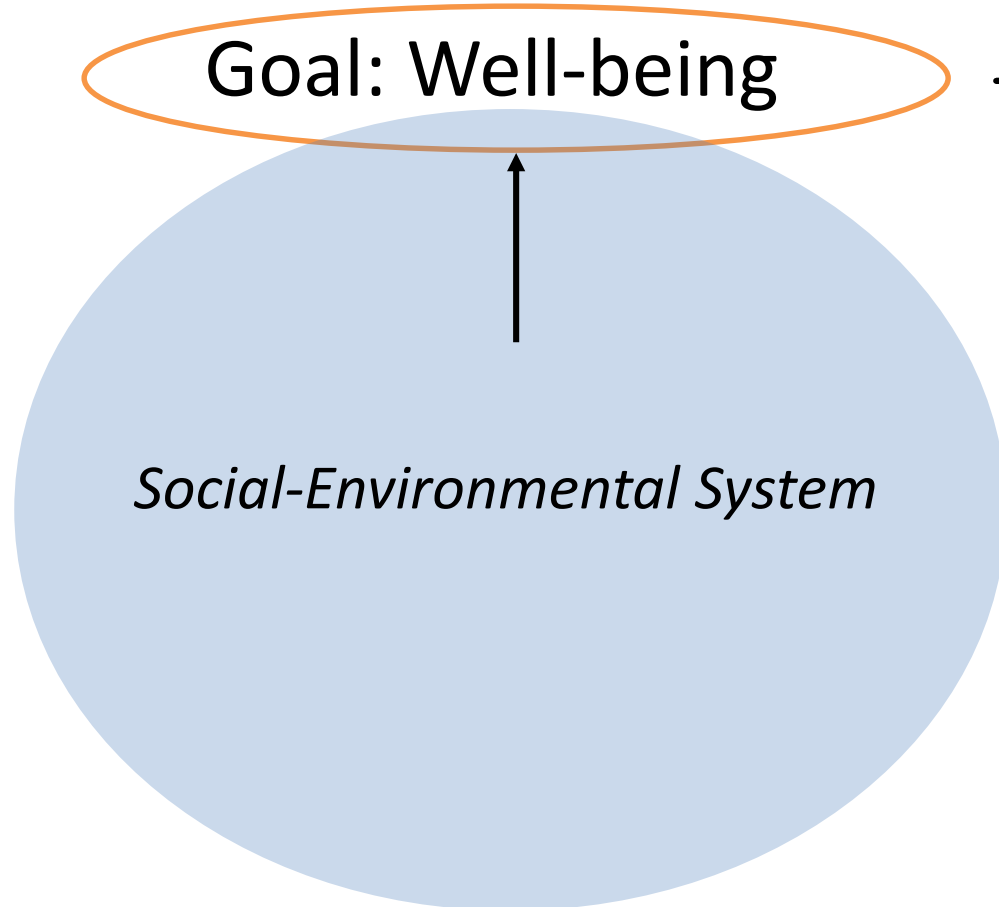


An emerging way forward...

- What is to be developed? *Human well-being*
 - Human centered, but advancing “well-being” as less austere vision than merely meeting “needs”
 - Conservation of nature is a possible *means* for, but not an *end* of, sustainable development
- What of equity? *Inclusive* human well-being
 - Fair division of opportunities for advancing well-being across space and time
- Bottom line: Goal of sustainable development is
 - inclusive human well-being doesn't decline with time



1) Normative Challenges: non-declining inclusive human well-being as goal of sustainability



Constituents of Well-being

- Material needs*
- Health and education*
- Flourishing biota*
- Capabilities...*
- ... & their distribution*

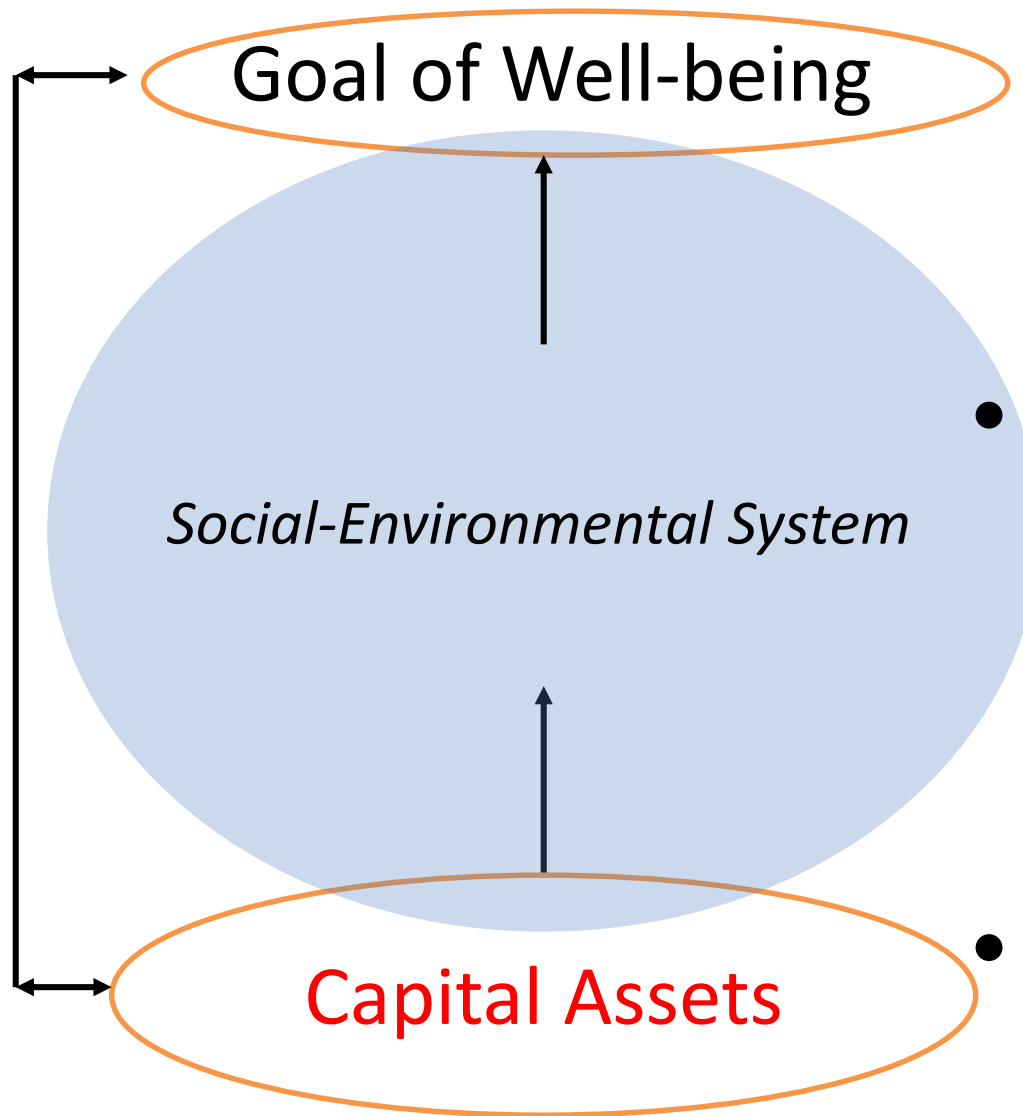


2) Analytic Challenges

- What are the ultimate determinants of inclusive human well-being (W), and thus of sustainable development?



2) Analytic challenges: Determinants of sustainability...



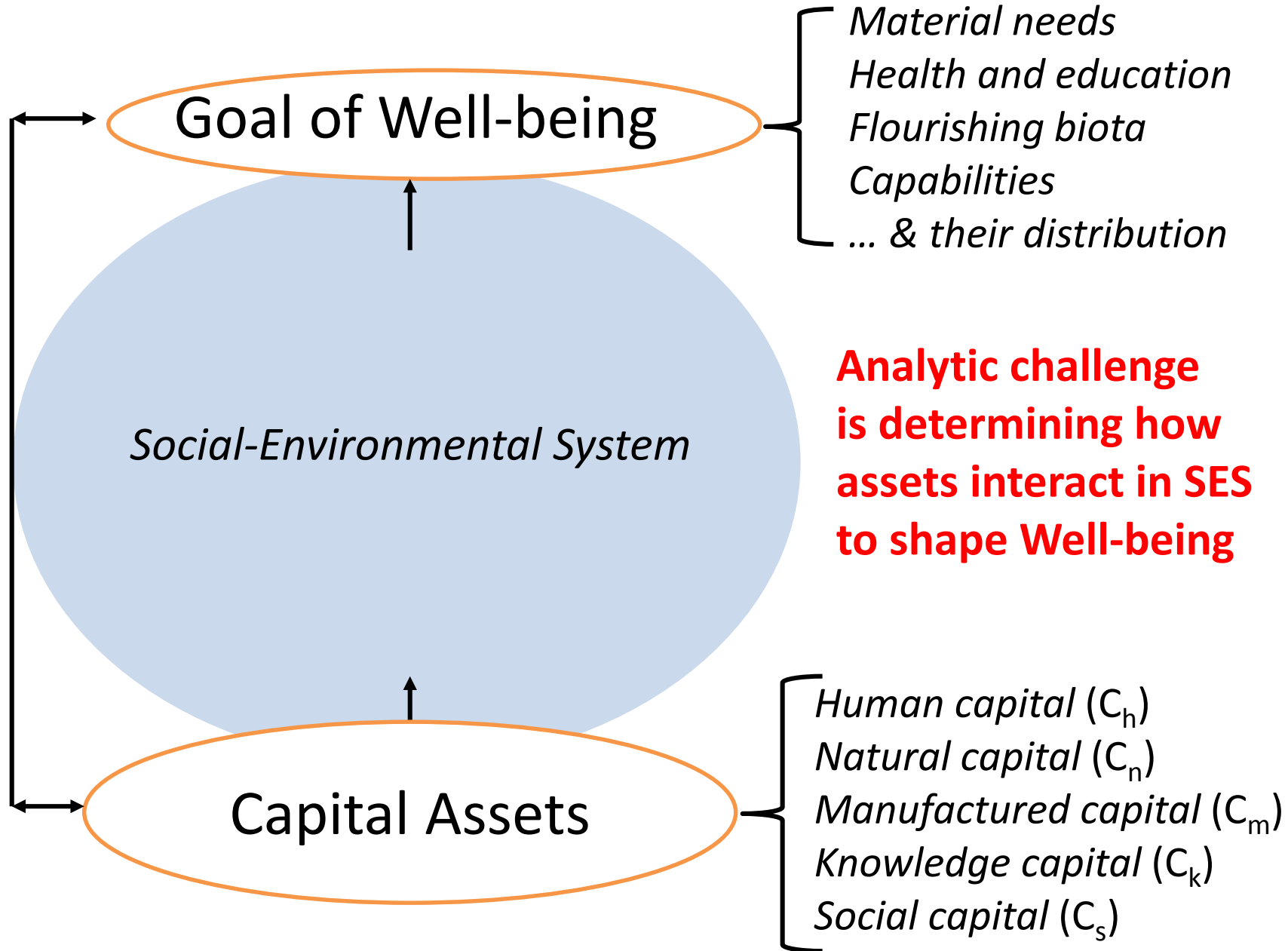
- Well-being ultimately derived from stocks of **capital assets**
- Assets are the state variables of the SES → *determinants* of sustainability
- But *which* assets?

Determinants of Inclusive Well-being

(And tribes of scientists that study them)

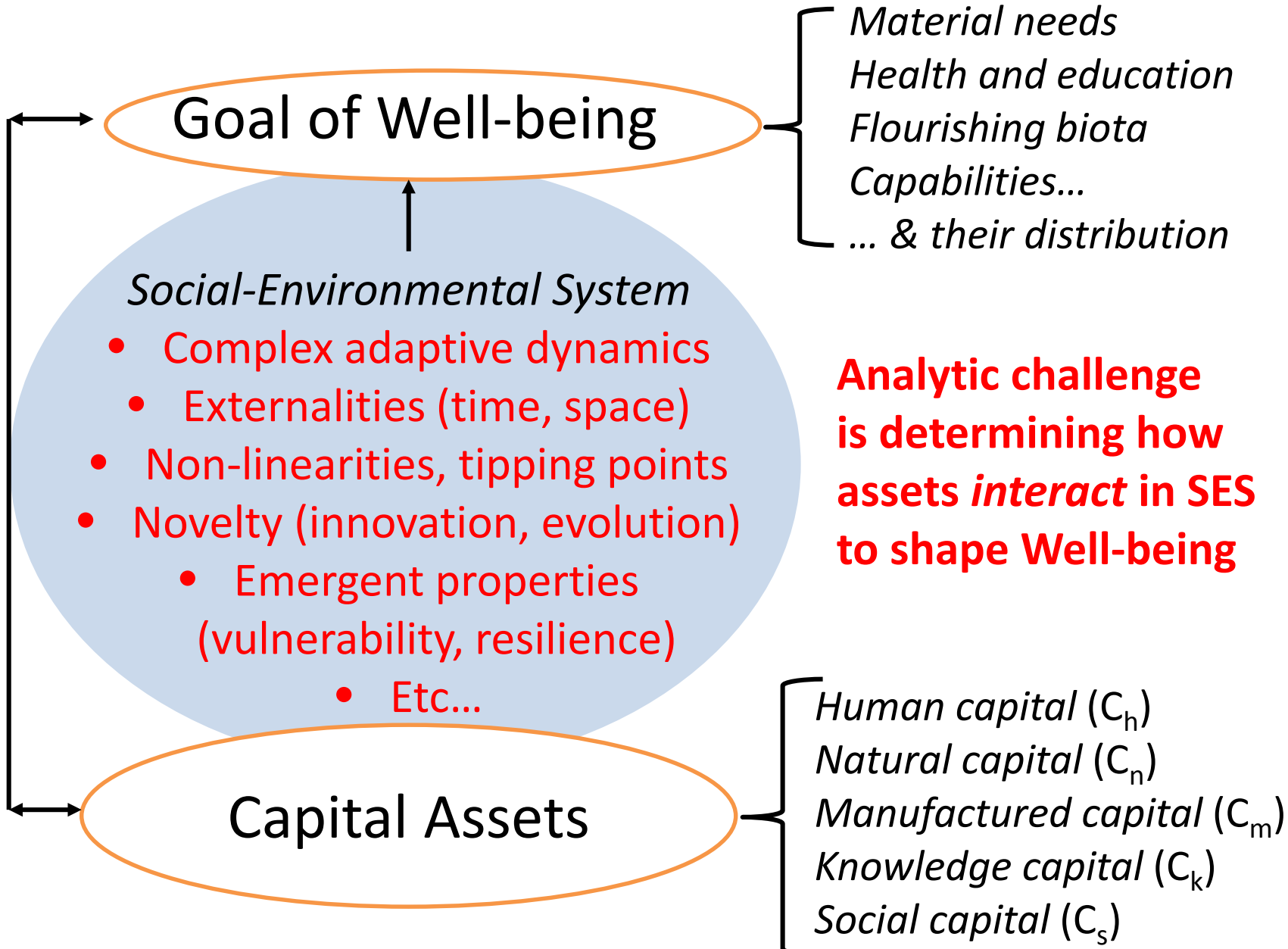
Asset cluster	Includes... “state variables” related to...	Studied by scholars of ...
Natural capital	Environmental system, its ecology, climate, soils, biodiversity, minerals, etc.	Earth systems science, conservation biology, ecosystem services, ecological economics
Manufactured capital	Industrial system: factories, roads, cities, infrastructure for energy, telecom, etc.	Industrial ecology, green design, pollution control; sustainability engineering
Human capital	Individuals: number/distribution, health, education, networks	Demography, consumption behavior, environmental health
Social capital	Arrangements (economic, political, cultural) governing interactions (rules, norms, trust)	Political economy, institutions, policy science, managing the commons, governance, sociology
Knowledge capital	Scientific findings, technology, practical skills and expertise	Research policy, innovation, STS, boundary work, social learning...

2) Determinants of sustainability: Statics



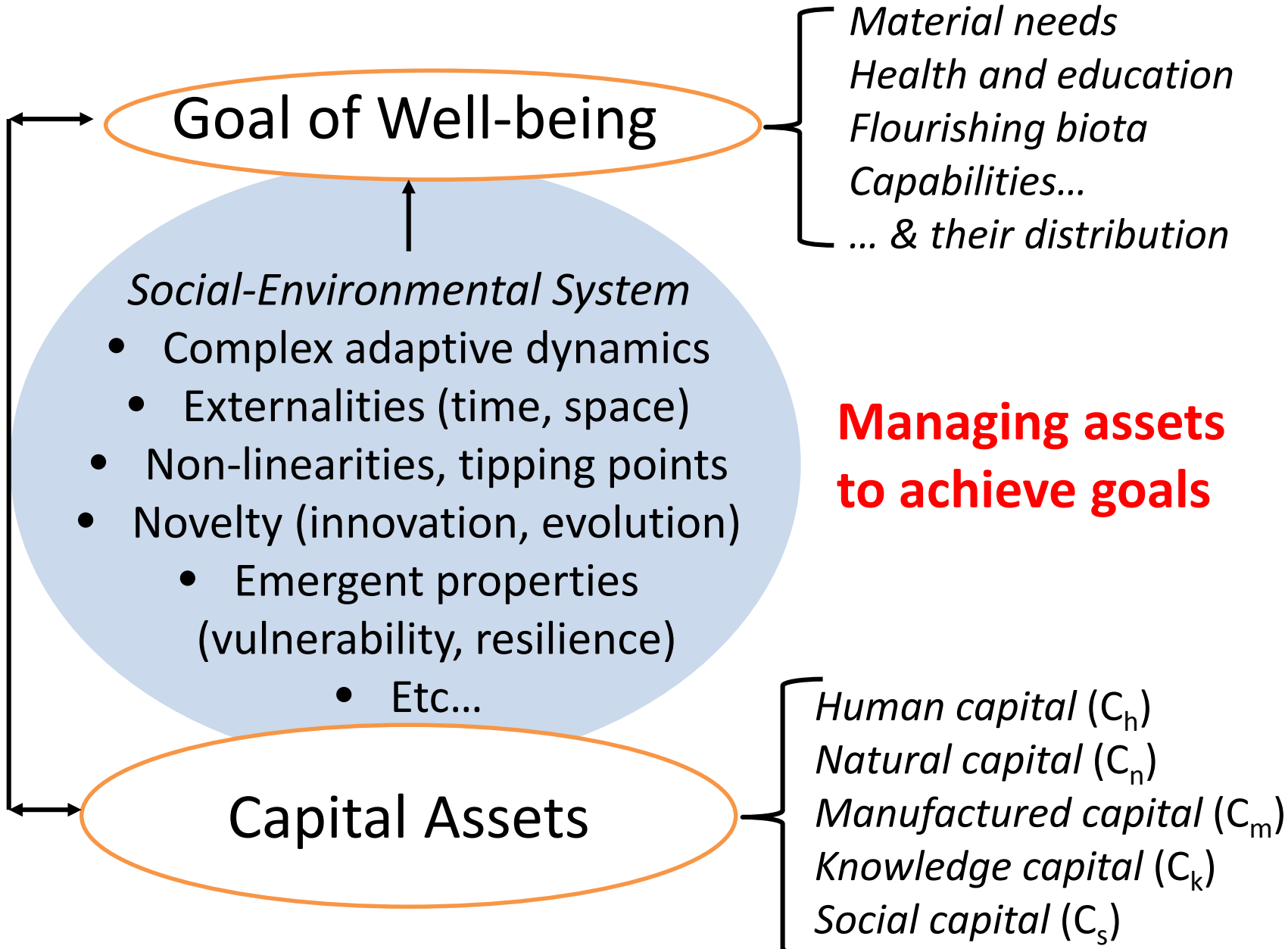


2) Determinants of sustainability: Dynamics





3) Operational challenges

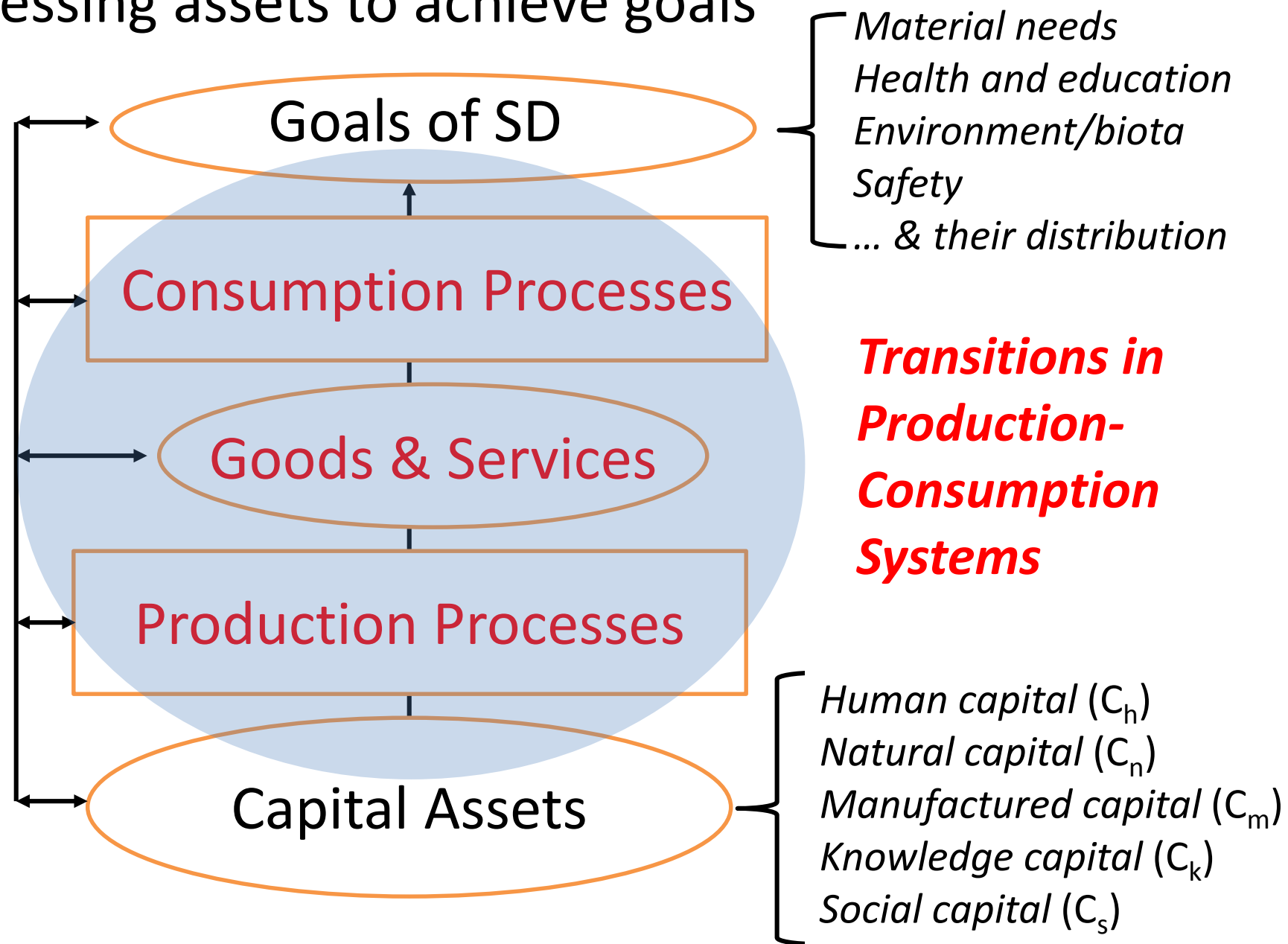


3) Operational challenges

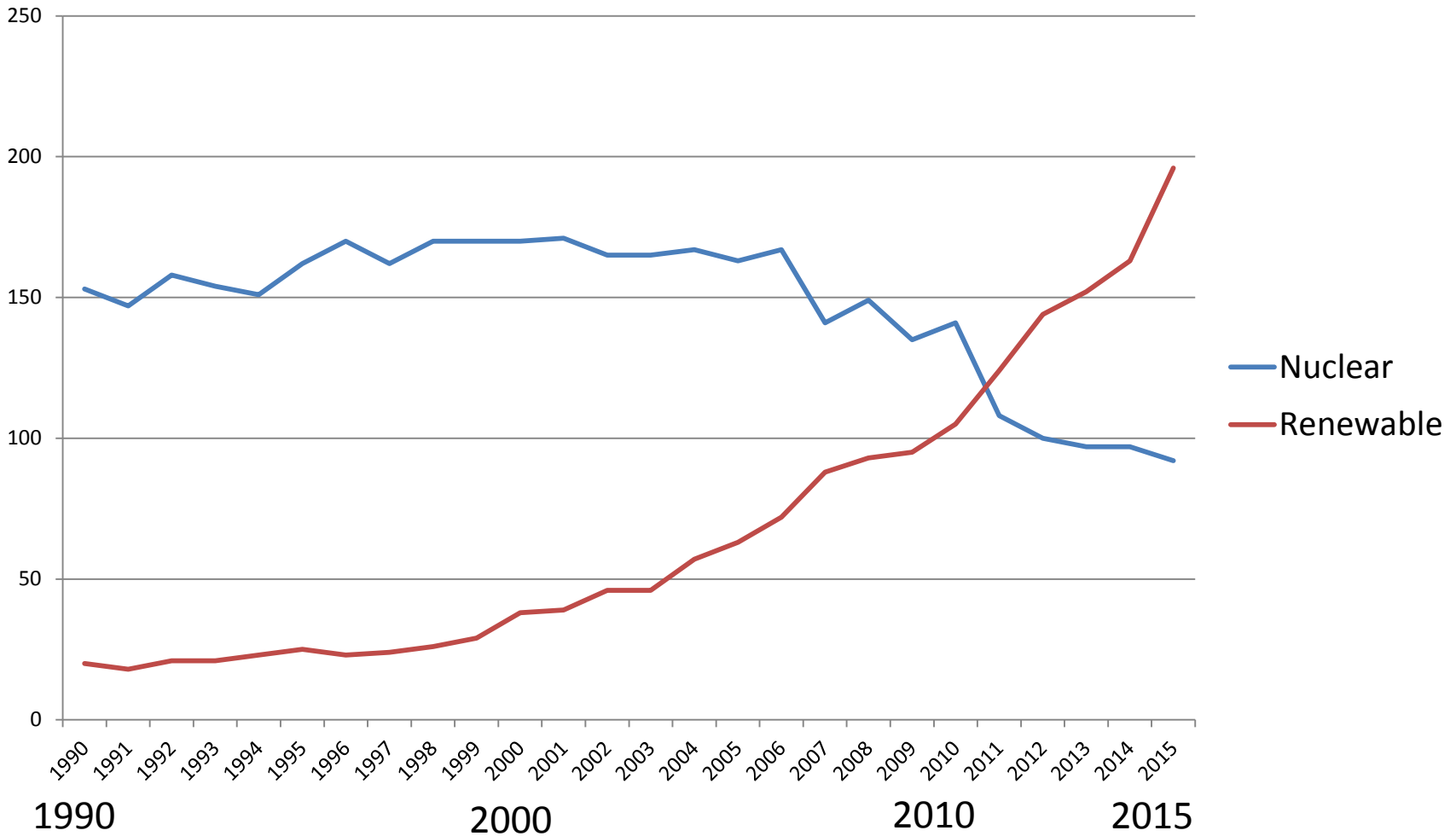
- Harnessing *assets* to achieve *goals* takes place through particular PCS (production-consumption systems) embedded in overall SES (social-environmental system) [e.g. energy PCS]
- Operational work must look beyond improvements in particular technologies, policies, consumption habits to...
- Promote *sustainability transitions* in full production-consumption systems
 - German Energiewende, Brazil Forest Transition



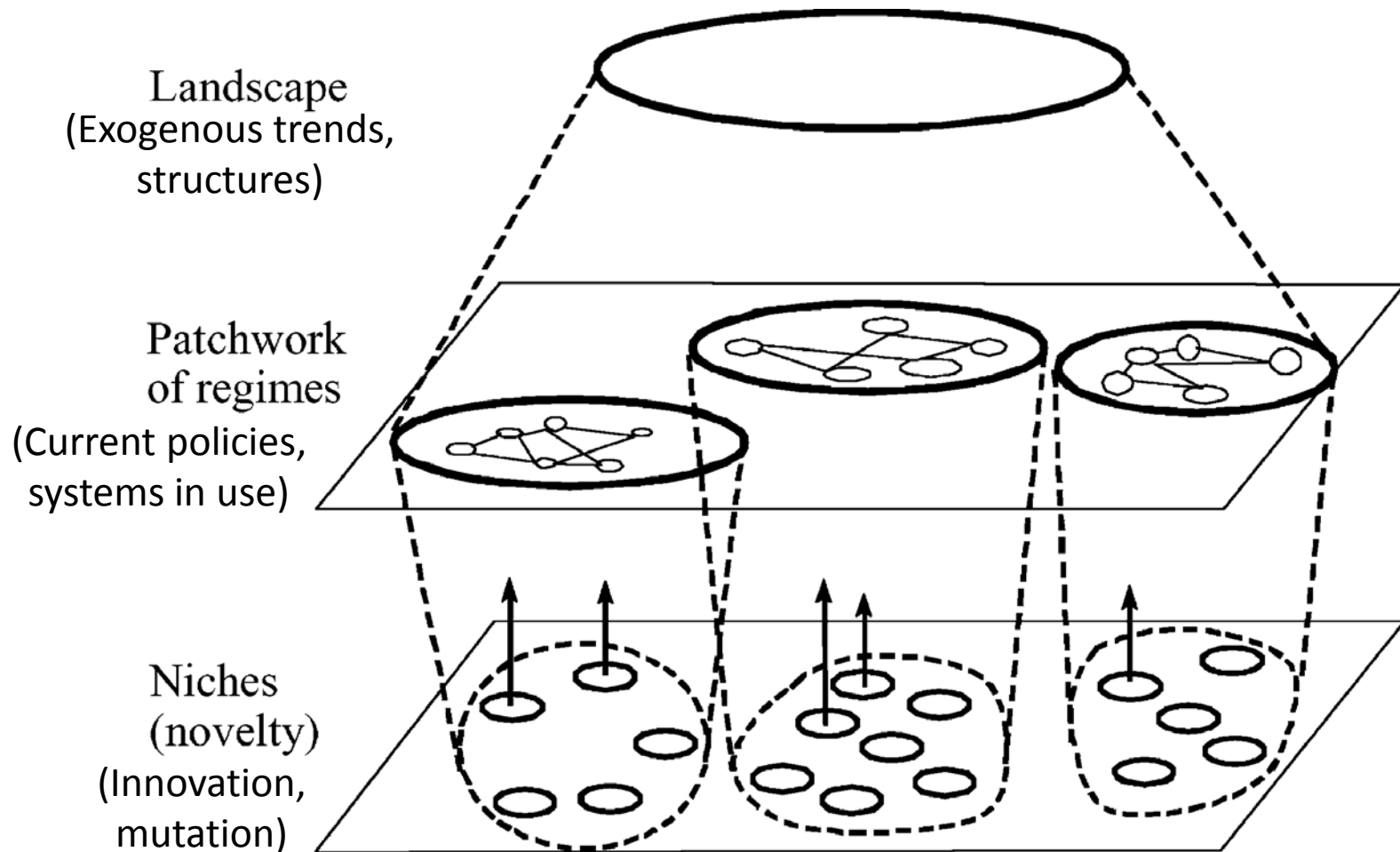
3) Operational Challenges: System transitions in harnessing assets to achieve goals



Germany's Energiewende (*Bruttostromerzeugung, Mrd. kWh*)

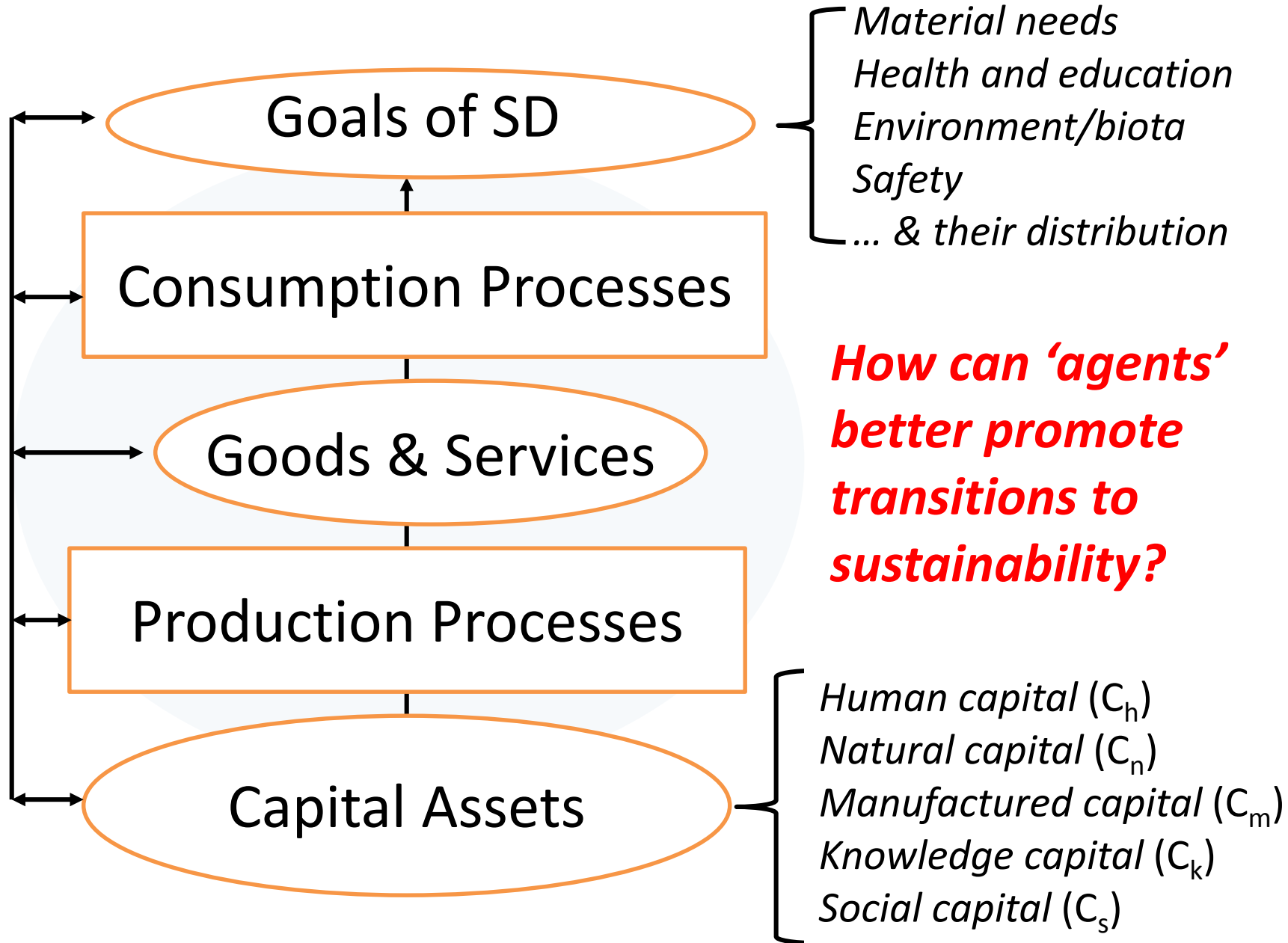


3) Operational challenges: Toward a theory of Transition Management in Production-Consumption Systems



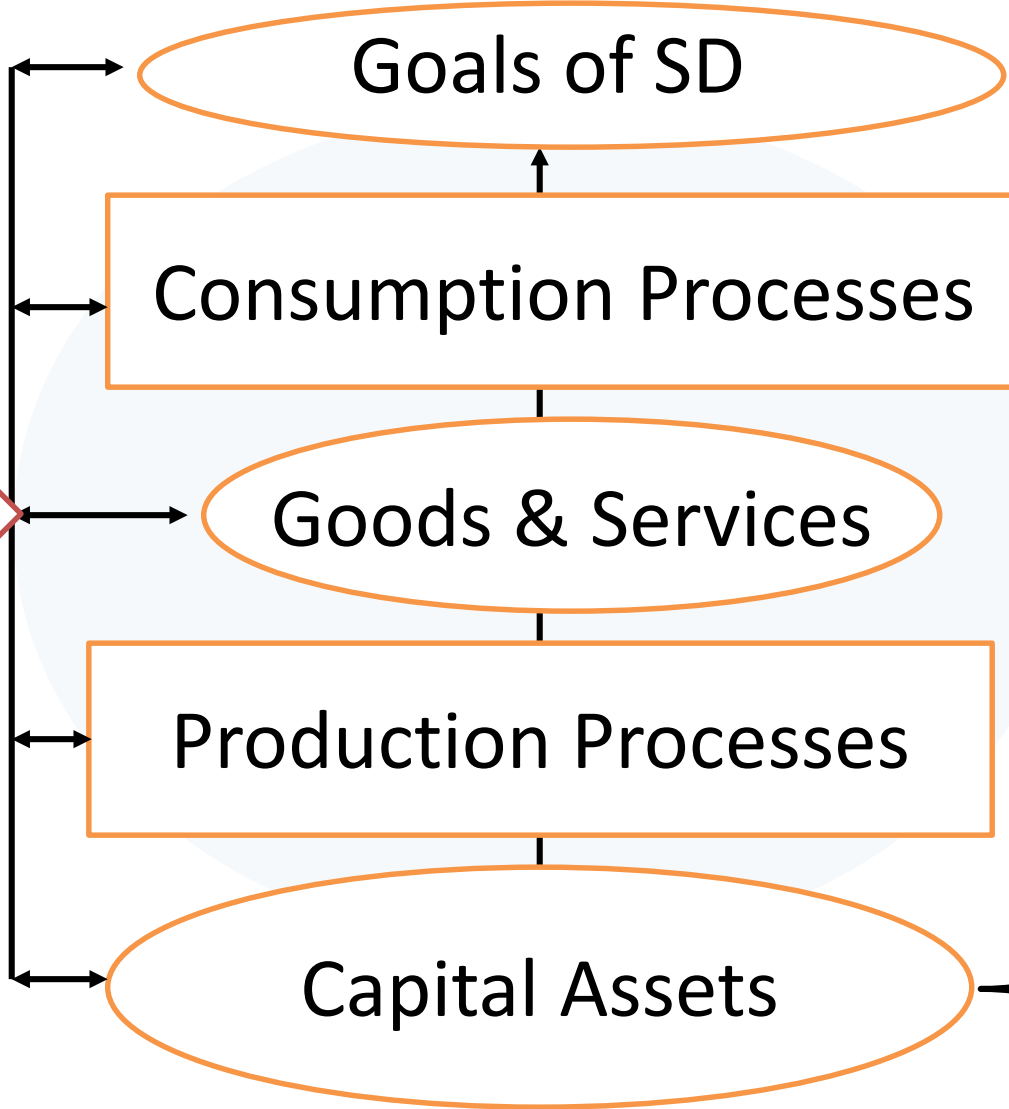
(Geels et al., 2002)

4) Strategic challenges



4) Strategic challenges: Action to promote sustainability transitions

Actors, power & agency

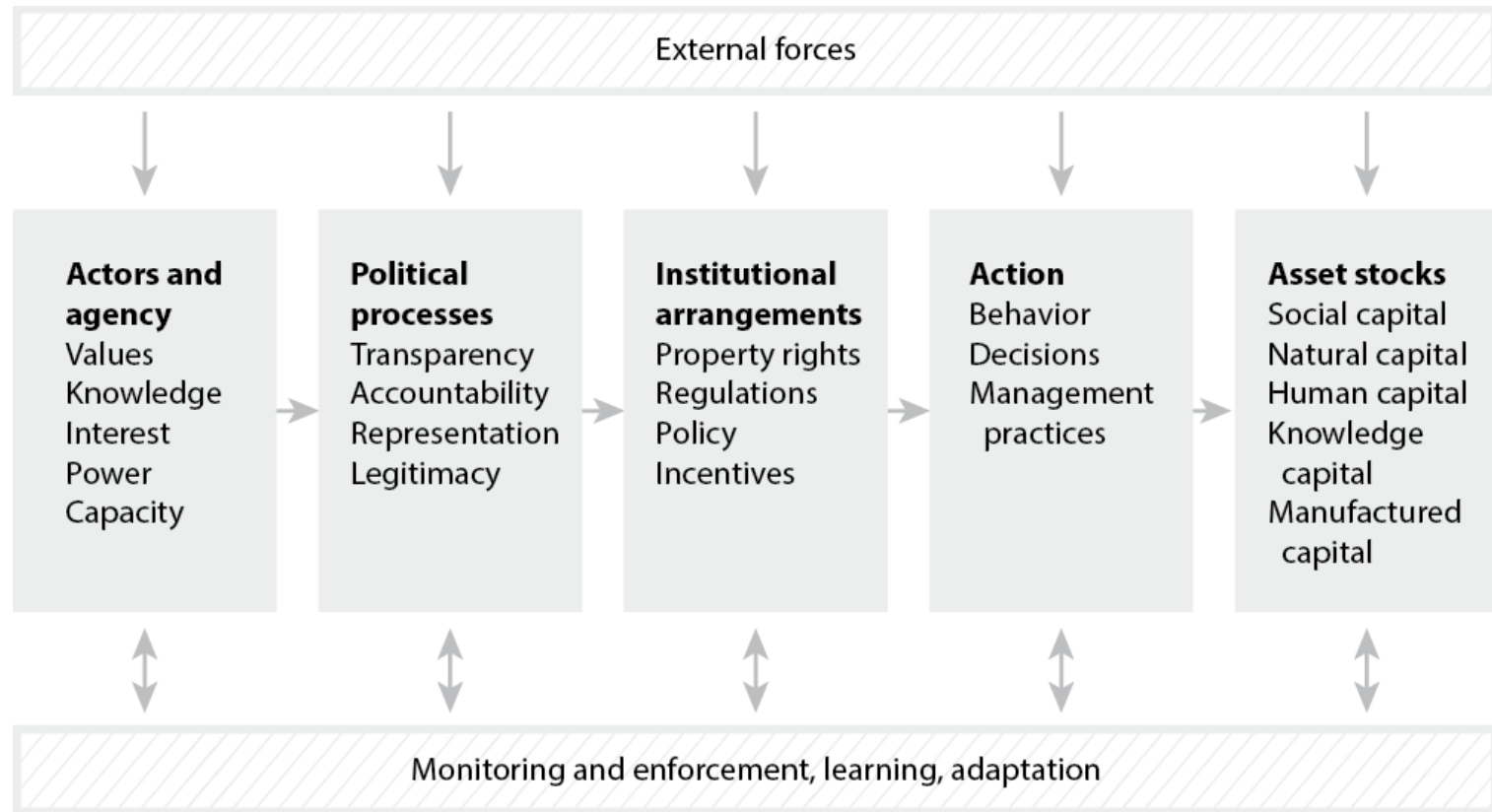


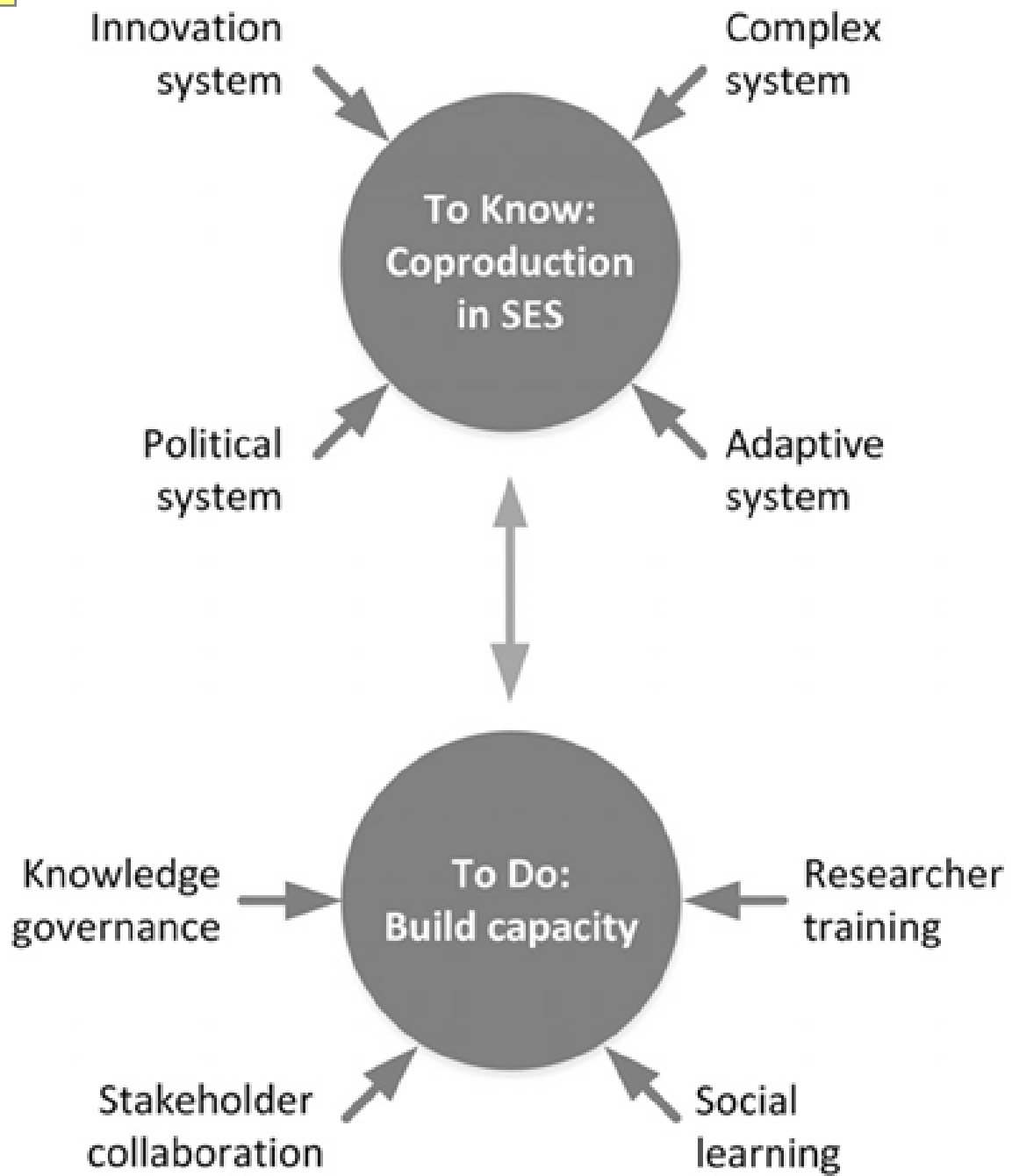
Material needs
Health and education
Environment/biota
Safety
... & their distribution

“Informed agitation” for an unequally empowered world...

Human capital (C_h)
Natural capital (C_n)
Manufactured capital (C_m)
Knowledge capital (C_k)
Social capital (C_s)

4) Strategic challenges: Informed **Agitation** Governance for Sustainability





Informing
agitation:
What
scientists
need
to know
and
to do



*Social-
Environmental
System*

Goals of SD

Consumption Processes

Goods & Services

Production Processes

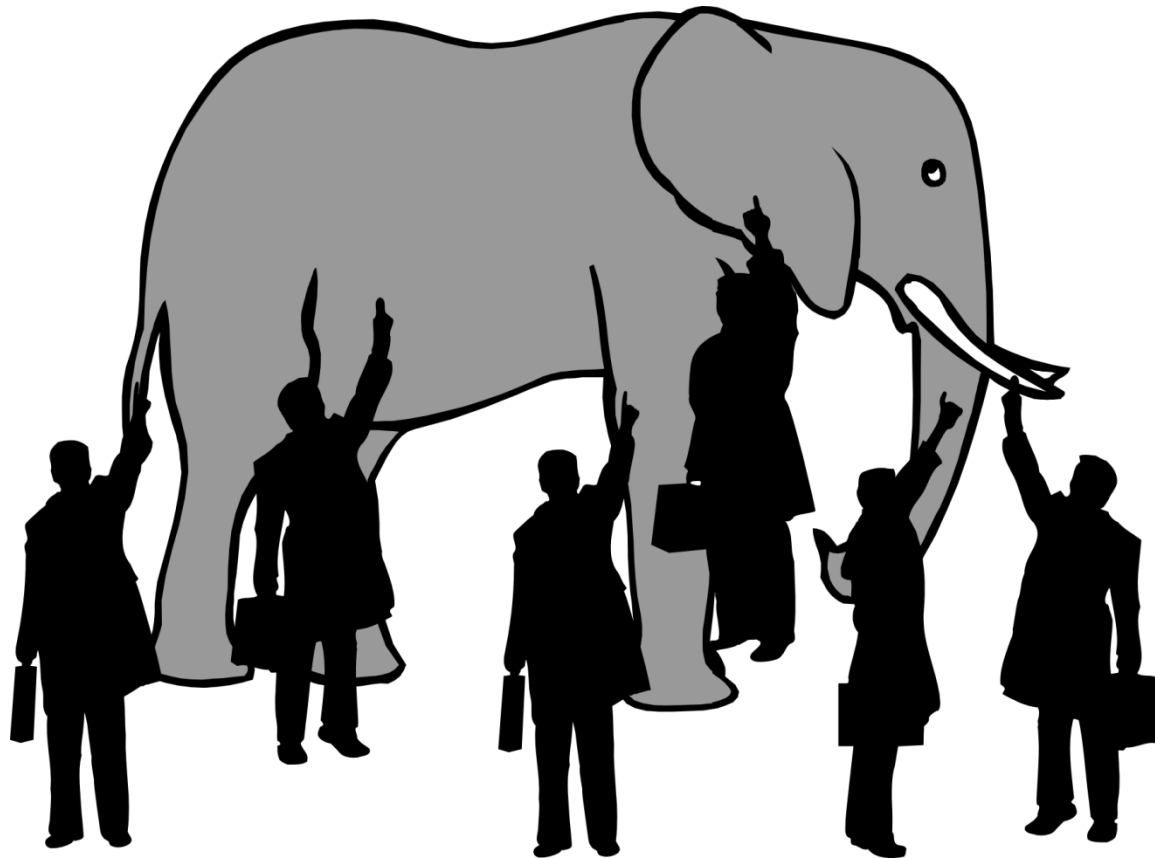
Capital Assets

Actors with Agency, Power

*One
Framework
for
Analyzing
Sustainable
Development*
(use by World Bank,
UNEP, scholars)



Useful in organizing interdisciplinary perspectives to understand the elephant of sustainable development?



And in harnessing that understanding to help guide the herd... the ultimate Grand Challenge of Sustainability Science





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Pursuing Sustainability:

Further Information

- Sustainability Science Program @ Harvard (This presentation and related materials)
 - www.hks.harvard.edu/centers/mrcbg/programs/sustsci
- *PNAS Sustainability Science* (current research)
 - <http://sustainability.pnas.org/>
- *Annual Review of Environment and Resources* (reviews of core topics in sustainability science)
 - <http://arjournals.annualreviews.org/loi/energy>
- *Pursuing sustainability: A guide to the science and practice* (new book by Pam Matson, Bill Clark, Krister Andersson; Princeton Univ. Press 2016)
 - <http://pursuingsustainability.org>